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# AIR POLLUTION AND TREE GROWTH

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## 1. INTRODUCTION

Air pollution, as a problem, has been with mankind for some considerable time, at least since his aggregation into large cities and into houses warmed by open coal fires. A celebrated early reference is John Evelyn's 'Fumifugium: the inconvenience of the aer, or smoake of London Dissipated' (1661), but it was not until the great industrial expansion of the 19th century that serious and sustained attention appears to have been given to the problem, and then chiefly in Germany in relation to agricultural and forest crops. Early works of importance include Schröder and Reuss (1883), Reuss (1893), Haselhoff and Lindau (1903), Wieler (1905), Sorauer (1911), Wislicenus (1914), and, after World War I, Stoklasa (1923), Haselhoff (1932), and Haselhoff, Bredemann and Haselhoff (1932). Since 1939, however, an increasingly important literature on the subject has come from N. America, e.g. Report of the National Research Council of Canada [Katz *et al.* (1939)]; numerous symposia and reviews in *Industr. Engng. Chem.*; Proceedings of the First, Second and Third National Air Pollution Symposia, Stanford Research Institute, Los Angeles (1949, 1952, 1955); and the Air Pollution Handbook, [Magill, Holden and Ackley (1956)].

The problem, however, now knows no boundaries, and although little or no information is available on the effects of air pollution on vegetation in S. America or in Asian countries (other than Japan), other aspects of the problem have been considered in places as far apart as Buenos Aires, the Rand towns of S. Africa, parts of India, especially Bengal province, Dairen (Talien) in Manchuria, and Wellington in New Zealand [see bibliography in Kramer and Rigby (1950)]. In Australia, signs of pollution damage to vegetation near Melbourne and Sydney were noticed by Went (1956), public concern is now being expressed about pollution conditions round Newcastle and Port Kembla, New South Wales, and the author recently examined pollution damage to *Eucalyptus* forest near aluminium works in Tasmania.

Bibliographies on the subject have gradually been growing in number and size, and a few reviews have also appeared. The U.S.A. has been most active in compiling bibliographies—from Harmor (1908) listing 232 references as relating, directly or indirectly, to pollution damage to vegetation, and McClelland (1913) with more than 1400 references on a diversity of aspects, to Davenport and Morgis (1954) who cited ca. 3900 references for the period up to 1953. This last and longest list, however, included fewer than 100 references to pollution damage to plants, and still fewer to trees or to the economic, physiological and other implications of such damage. As regards reviews on particular topics, Thomas (1951) reviewed the physiological aspects of gas damage to plants, chiefly herbaceous plants, and later (1956) considered the effects of air pollution upon plants in general, Zieger (1956–57) surveyed the effects of air pollution on the forests of E. Germany, and Wentzel (1958) has recently done the same for the region Nordrhein-Westfalen.

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The need for more intensive study of the effects of pollution on tree establishment and growth was underlined by the discussions of the Forest Section of the British Association for the Advancement of Science in 1956 [Grayson (1956)].

## 2. DEFINITION OF AIR POLLUTION

From the standpoint of commercial forestry, a polluted atmosphere may be defined as one in which the concentrations of injurious substances, i.e. pollutants, are such as materially to reduce timber yields on a site which, in all other respects, is apparently within the physiological range for economic growth of the species in question. A broader definition would be required if one included the maintenance of protection forest (as in shelterbelts or on catchments) or the establishment, satisfactory growth, flowering and fruiting of ornamental trees and shrubs in urban and industrial areas.

## 3. ORIGINS AND EFFECTS OF AIR POLLUTION

It is convenient to distinguish, somewhat arbitrarily, the effects on trees and shrubs of *general air pollution*, from the effects of *specific pollutants*. The former will be considered first.

### (A) GENERAL AIR POLLUTION

(i) *Introductory remarks*. The effects of general air pollution can be taken to be those produced in or near large urban and industrial centres where a considerable number of contaminants reach the atmosphere from a variety of sources. The considerable mixing, dilution and interaction that these contaminants undergo in the air often renders it exceedingly difficult to assign pollution damage to any specific chemical or physical entity. It is, moreover, often impossible to assign responsibility for damage to any particular source, a fact emphasized recently [Anon (1956)] by the increasing number of so-called ‘area complaints’, i.e. complaints directed against emissions from a highly industrialized area or one of intensive production, dealt with by inspectors under pollution ordinances in Great Britain. It is in such countries, closely populated, where the distances separating large afforested, or potential forest, areas from urban and industrial centres are often relatively short, that the problem of general air pollution is causing greatest concern to forestry interests.

(ii) *Effects on trees and shrubs*. A signal illustration of the well-known fact that conifers cannot generally be successfully grown in and near industrial centres was the removal, in 1924, of the National Pinetum of Great Britain from Kew, near London, to Bedgebury in Kent. The author (1955) recorded *Taxus baccata*, *Chamaecyparis lawsoniana*, *Juniperus communis* and *Cupressus macrocarpa* as being adversely affected, with *Taxus* showing the least damage, in such centres in Great Britain. Deciduous trees were more tolerant, especially those capable of fairly rapid growth (e.g. *Populus* spp.) and of producing new shoots fairly readily when injured. But even apparently tolerant trees and shrubs, under such conditions, often exhibited marked earliness of autumn leaf-fall, a feature also emphasized, for example, by Cohen and Ruston (1925) and recently by Antipov (1957*b*). The replacement of a normally evergreen habit by a deciduous one was noted in a number of species, notably *Ilex aquifolium* and *Ligustrum lucidum*. Conder [reported by Grayson (1956)], also in Great Britain, found *Acer pseudoplatanus*, *Ulmus procera*, *Fagus sylvatica* and *Populus* sp. to be the most successful timber-producing hardwoods in the vicinity of large industrial centres. Of conifers tried, only *Pinus nigra* var. *austriaca* and the deciduous *Larix leptolepis* were of any value. Observations of this sort have been made in other countries. Jennings (1934), for example, listed trees in order of their observed susceptibility to pollution in Pittsburg, U.S.A. Knabe (1954–1955) produced a similar list for Berlin, based on observations and published literature; Pelz (1956) compiled a list for a district near Freiberg (Saxony); Glocker and Krüssman (1957) a broader-based one from the observations of public authorities in 20 Ruhr towns; Dobrovoljskiĭ (1952) & Ferda (1953) compiled similar lists for the iron-smelting region of Krivoi Rog (Ukraine) and the Erz Gebirge region of Bohemia respectively. Amongst conifers, *Pseudotsuga taxifolia* and *Abies alba* are usually regarded as least, and *Pinus nigra*, *P. mugo*, *P. cembra*, *Abies concolor* and *Picea omorika* as most, tolerant to industrial smoke, the highest tolerance rating being generally assigned to *Pinus nigra* var. *austriaca*. Apart from general agreement that *Populus* and *Alnus* spp. are relatively tolerant, the most obvious feature of the above and other lists is the differences of opinion expressed, particularly as to the relative susceptibility of hardwood species. This, perhaps, is to be expected when one considers the chemical complexity of general pollution—see (iii) below—and the differences in composition of the fuel being burnt, in the type of industry operating, and in the topography, climate and soil of individual sites.

Damage to *Pinus pinaster* and *Eucalyptus globulus* near a mine in Portugal [dos Santos (1954)], to Spruce near an industrialized area in N. Bohemia [Němec (1952); Vulterin (1952)] and to a mixed Pine/Oak/Birch wood about a burning spoil-mound of a Ruhr coalmine [Wentzel and Bruns (1956)], has been attributed wholly or partly to $SO_2$. However, until more certainty exists as to the causative agent(s), such cases might be considered as 'general pollution' effects. Similarly, the curtailment of the growing season of a number of trees and shrubs near chemical works in Leningrad [Antipov (1957*b*] and what is nowadays called 'smog' damage might be included in this general category, even though something is known of the chemical nature of the pollutants responsible.

Regarding smog damage, relatively few of the considerable number of references deal with woody perennials, and these are orchard crops. Damage to grape vines by $O_3$ is reported by Richards, Middleton and Hewitt (1958) in the Los Angeles area. Taylor (1957) obtained a 20% reduction in the fresh weight of grapefruit seedlings exposed for 6 months to Los Angeles smog, compared with seedlings grown in air filtered through activated carbon. Both natural and synthetic (mixed $O_3$ and hexene) smog also reduced the rate of water consumption by seedlings of avocado, grapefruit, navel orange, valencia orange and lemon by 15 to 45%. Growth of avocado and grapefruit seedlings, as shown by stem elongation, leaf area, and fresh and dry weights, was reduced by continuous exposure to synthetic smog in which the oxidant concentration (as determined by the amount of $I_2$ released from buffered KI solution) was 0·15 p.p.m. Taylor *et al.* (1958) obtained reductions in stem diameter and length, leaf width and length, and fresh and dry weights of avocado seedlings that were fumigated for 280 hours over a period of 8 weeks with the reaction products of a mixture of $O_3$ and 1-*N*-hexene vapour. Todd, Middleton and Brewer (1956) had previously reported a reduction in diameter of avocado seedlings after 6 months' fumigating with mixed $O_3$ and petrol. Later Taylor (1958) found that an $O_3$/hexene synthetic smog not only significantly reduced the growth of rooted Lisbon lemon cuttings, grapefruit seedlings etc., but did so without producing visible symptoms of damage on the leaves. Such observations are relevant when considering the so-called 'invisible injury' concept of pollution damage (see p. 346). Premature senescence and drop of the older lemon leaves also resulted from extended exposure to either synthetic or natural smog.

(iii) *The nature of general air pollution.* By far the greater amount of such pollution arises from the combustion of fuels such as coal and petroleum products (fuel oil, aviation and motor spirit, kerosene, gas and diesel oils, and other fractions), e.g. in domestic heating, industrial and railway operations, and the generation of electricity in power stations and of gas in gasworks. Specific industries, such as steel works operating within the urban area at Sheffield, England, also contribute more or less specific pollutants that arise in the processing of their raw materials.

The constituents of general air pollution may be subdivided into (*a*) those potentially incapable, and (*b*) those potentially capable, of entering the plant either through leaf stomata (and possibly lenticels) or indirectly by way of the soil. Group (*a*) would include those solid, suspended impurities that are insoluble in water—ash, grits and dusts. A substantial fraction of these settles under gravitation or is brought down by rain and snow [see, e.g. Gilbert and Linsey (1955)] and deposited on vegetation and soil. In Great Britain, Meetham (1950, 1954, 1956) estimated that the amount of ash (determined by igniting at 800° C. the insoluble matter collected in deposit gauges and weighing the residue) emitted through the combustion of about two million tons of coal and subsequently deposited, was of the order of one million tons per annum. Deposits, usually $<$ 100 tons/sq. mile/year in rural areas and between 200 and 400 tons in urban areas and large cities, usually exceeded 500 tons in heavily industrialized districts and over small areas could reach the equivalent of 2000 tons/sq. mile/year [Parker (1954)]. Over most of Britain smoke (carbonaceous matter), as estimated from the loss in weight when insoluble matter in deposit gauges was ignited at 800° C., deposited a total of 0·8 million tons per annum, an additional 1·5 million tons probably being blown out to sea [Meetham (1950, 1954)]. Meetham estimated the average life of a smoke particle in the air before deposition to be of the order of 28 hours. Before deposition, such solid constituents of polluted air play their part in reducing the transmission of sunlight and, by acting as condensation nuclei, increase the incidence, density and persistence of fogs over industrial areas compared with those over the country. At Kew Observatory, Wright (1939) estimated that in average afternoon conditions there, removal of smoke particles from the air would improve visibility from 50–200 yards to 1–2 miles. Bilham (1938), Dobson (1948) and

Brooks (1950) have illustrated the effect of polluted atmospheres in reducing the duration of bright sunlight; in Central London this might be only 45% of that in surrounding country districts. According to data obtained in the D.S.I.R. survey of atmospheric pollution in Leicester [Anon (1945)], loss of ultra-violet daylight in the city centre exceeded 50% during winter months, the amount varying with the velocity of the prevailing winds. Such losses occur chiefly in the early and late hours of the day when the concentration of atmospheric pollutants is highest [Dobson (1948)]. The effect of such pollutants on fog formation can be seen from the charts in the *Climatological Atlas of the British Isles* [Anon (1952*a*)]. These indicate, not only that fogs occur more frequently in winter months, but also that the highest frequencies of fog and thick fogs occur in the London, Clyde-Forth and Midlands areas where industry is concentrated and population densities are high. How far the above factors—reduction of sunlight, frequency and severity of fogs, deposition of solid particles—may impair tree growth, is uncertain. Horticulturists in general believe that washing improves the growth of plants with heavy deposits on their leaves. Rhine (1924) considered that such deposits did not inhibit the gaseous exchange of conifer leaves in smoke-polluted atmospheres but Eršov (1957) reported that dusting the leaves of *Tilia cordata* and *Ulmus pumila* var. *arborea* with the smoke discharge of a coal-fired boiler reduced their ability for photosynthesis.

Possible constituents of air pollution that might be allocated to group (*b*) above, include many of those (> 30) listed as 'noxious and offensive' under the Alkali, etc., Works Regulation Act, 1906, of Great Britain. That such a list is by no means exhaustive is shown by the results of recent analyses. Numerous organic and inorganic substances have been identified in Los Angeles smog, including formic acid, organic acids containing between 2 and 12 carbon atoms, aldehydes and ketones, organic halides and hydrocarbons [Magill (1949); Anon (1948–51*a* and *b*); Shepherd *et al.* (1951); Cadle and Johnston (1952)]. More recently, Cooper (1953) identified in the smoke over Salford, England, the hydrocarbons acenaphthylene, anthracene, anthanthrene, 1:2 benzanthracene, 1:12 benzperylene, 1:2 benzpyrene, 3:4 benzypyrene, chrysene, fluoranthene, pyrene and an alkyl pyrene. Antipov (1957*b*) listed methane, ethylene, acetone, acetic acid, ethyl chloride, ether, benzene, and chlorine amongst the pollutants from 3 Leningrad chemical works. In addition, however, to substances emitted directly to the air, other, at present undetermined, substances are formed secondarily by chemical and physical processes in the polluted atmosphere (see p. 343). It is also becoming increasingly evident that certain radioactive isotopes will have to be added to the list of air pollutants. Indeed, if nuclear power stations increase in number and nuclear explosions continue to be made, radioactive wastes may replace the products of coal combustion as the major contaminators of the air.

Of the gaseous constituents of general air pollution known to cause damage to trees and other plants, $SO_2$ and F compounds appear to be the most important. In Great Britain, for example, Meetham (1950, 1954) estimated that 5 million tons of $SO_2$ were probably generated annually as a result of coal combustion; two-fifths of this $SO_2$ come from domestic fires and electricity-generating stations [Parker (1954)]. Meetham estimated that 3·9 million tons of the $SO_2$ was deposited on land and 1·1 million tons blown out to sea; the average life of a $SO_2$ molecule after release to the air was probably about 9 hours. A great variety of S compounds has also been identified. Jacobs (1952) indicated that peroxysulphates, COS, many organic compounds such as thiols and sulphides, as well as $CS_2$ and free S, may at times be present in polluted air, in addition to $SO_2$, $SO_3$ and $H_2S$. As regards F compounds, health authorities make no routine determinations from solids and rain water collected in deposit gauges; but that F compounds are likely to be important constituents of general air pollution, follows from their occurrence in coal. Churchill, Rowley and Martin (1949), in giving the F contents of the foliage of various species in the Pittsburg area, U.S.A.—17 to 106 p.p.m. dry weight for certain Pines, 9 to 269 for fruit trees, and 6 to 226 for other deciduous trees—pointed to coal combustion as an important source of air-borne F compounds. Certain coals burnt in the Pittsburg area contained between 145 and 295 p.p.m. of F. Meetham (1956) gave the F content of British coals as up to 0·01% by weight, while the Cl content varied between 0·1 and 0·7%, small amounts of P, Pb and As also being present. Meetham (1950) also estimated that the total emission of chlorides from coal combustion in Great Britain amounted to 500,000 tons per year, but that more than half the chlorides deposited on land came from the sea. Gorham (1958) has attributed the low pH of the rainfall over two large cities in England as due to HCl rather than $H_2SO_4$ in the air.

The importance of CO released in the exhaust gases of cars, lorries and, to a lesser extent, aeroplanes, as an air pollutant has been stressed by Parker (1954) and by Gold [see Wilkins (1954)]. Parker, on the basis of an annual consumption of 5·7 million tons of motor and aviation spirit in Great Britain in 1951, estimated that 4 million tons of CO were released in exhaust gases. Making certain assumptions, Gold calculated that CO concentrations in streets congested with motor traffic might reach 200–500 p.p.m. These concentrations are of the same order as those shown by Zimmermann, Crocker and

Hitchcock (1933) to cause epinasty of the leaves of the tomato: their effects upon trees are unknown. High concentrations of CO at or near street level may be partly responsible for the difficulty of establishing and maintaining roadside trees in city streets. In addition to CO from exhaust gases, Parker (1954) estimated that a further 20 million tons could be released each year from the combustion of coal and similar fuels, though the potential dangerous effects of such amounts were reduced by the ease with which the gas, especially when discharged from tall chimneys, was dissipated in the air under normal meteorological conditions.

As regards water-soluble gases, such as $H_2S$ and $NH_3$, these are probably largely removed from the air in rain and by absorption on moist surfaces. There appear to be no data on the concentrations of these gases in the air, in rainfall or in fog droplets. Zimmermann (1952) reported that concentrations of $H_2S$ in excess of 400 p.p.m. would be needed to injure Apple, Cherry and Peach trees. Junge and Ryan (1958), investigating the oxidation of atmospheric $SO_2$, in cloud and fog droplets, to $SO_4$, have suggested that the steady increase in sulphate aerosols, often observed during a period of 'smog', may reflect the amount of $NH_3$ released in the smog area. By neutralizing the $SO_4$ already formed in fog droplets, $NH_3$ was supposed to facilitate solution and oxidation of further $SO_2$ in such droplets. This example serves to illustrate the possible importance of interactions between aerosols and gases in the atmosphere.

The importance of photochemical reactions taking place in the air and involving pollutants after their release from various sources, is evident from the results of the intensive investigations into the agents responsible for the so-called 'smog' effects in Los Angeles [Blacet (1952); Haagen-Smit, Bradley and Fox (1953); Cann, Noble and Larson (1954); Noble (1955); Symposium papers in *Industr. Engng. Chem.*, 1956; Cadle and Magill (1956); Haagen-Smit (1958)]. Haagen-Smit (1952), Haagen-Smit *et al.* (1952), Middleton, Kendrick and Schwalm (1950), and Taylor (1958) have all reported that certain straight-chain unsaturated hydrocarbons with 5 or 6 carbon atoms in the chain, produced symptoms of damage on a number of indicator plants, comparable to those produced by Los Angeles 'smog'. Similar effects have since been demonstrated in the presence of $O_3$ by car exhaust fumes diluted $> 100$ times with air filtered through an activated carbon filter. The concentration of hydrocarbons in the diluted fumes was 0·04 mg./litre, and of $O_3$, 0·4 p.p.m. [Cann, Noble and Larson (1954); Noble (1955)]. The agents responsible for the damage caused were presumed to be peroxyacids and other intermediates formed by the oxidation of the hydrocarbons. Investigations centred, therefore, on the processes by which $O_3$ might be generated in the air. As only visible and long-wavelength ultra-violet (that is, between 8000 and 2900 Å) light waves are important in the lower atmosphere, photochemical formation of $O_3$ and $O_2$ is unlikely. $O_3$ has since been shown to be a product of the photochemical oxidation of hydrocarbons by N oxides in bright sunlight. Such $O_3$ can then oxidize hydrocarbons directly. The chemical reactions involved in photochemical oxidation of hydrocarbons and oxidations involving $O_3$ are complex: they are at present under active investigations [Miller, Brown and Franson (1958) and papers in *Industr. Engng. Chem.*, 1956; Thomas (1956); Magill, Holden and Ackley (editors), (1956)]. It can be said, however, that in control measures for eliminating the effects of smog there is a case for reducing the amounts of oxides of N (released during fuel combustion or generated by fixation of atmospheric N in internal combustion engines) as well as of hydrocarbons emitted to the air [Haagen-Smit and Fox (1956)], at least in large cities. In Great Britain for example, the extent of the problem may be judged from the fact that, in 1951, consumption of all forms of petroleum products amounted to some 16·9 million tons [Parker (1954)]. Photochemical reactions involving other constituents of air pollution are considered by Cadle and Magill (1956). Notable among these is the slow photochemical conversion of $SO_2$ to $SO_3$ in the presence of $O_2$; about 1·0% of the $SO_2$ present in the air is oxidized per hour in intense sunlight [Johnstone and Coughanowr (1958)]. Oxidation is faster in water solution under the influence of metal salts such as might occur in smoke plumes.

### (B) SPECIFIC POLLUTANTS

(i) *Sulphur dioxide.* $SO_2$ discharged from smelters has long been regarded as a, if not *the*, major cause of damage to vegetation, including trees and shrubs. Indeed, from the days of outdoor heap-roasting of sulphide-containing ores of Cu, Pb, Zn and Fe, pollution litigation, in nearly all countries where smelting operations have been carried out, has tended to centre on $SO_2$. Lauder (1909), for example, gave an account of the litigation that arose out of damage by smoke from the outdoor heap-roasting of iron ores, to mixed plantations of trees at Loganburn, Scotland, in 1877. Schröder and Schertel, in a prosecution case of 1884, investigated damage caused to vegetation by smoke from smelters at Freiburg, Germany. In both cases, $SO_2$ was regarded as chiefly responsible for the damage. Much publicized cases of a similar sort in the U.S.A. and Canada have involved smelters near Anaconda, Montana [Haywood (1910); Hedgcock (1912)], at Redding and other places, California [Haywood

(1905, 1910); Holmes, Franklin and Gould (1915)], at Ducktown and Copper Hill, south-eastern Tennessee [Hedgcock (1914)], smelters south of Salt Lake City, Utah [Widstoe (1903); Swain (1923)] and at Trail, British Columbia [Katz *et al.* (1939)]. Such cases have not, however, passed without doubt being expressed as to whether $SO_2$ was, in fact, the sole cause of damage. Smoke from the Anaconda and Salt Lake City smelters, for example, contained large amounts of suspended solids, including Cu and $As_2O_3$. Toumey (1921) commented on the problem when attributing the damage done to coniferous forest in the Naugatuck Valley, Connecticut, to smoke from brass and other works, this smoke containing not only $SO_2$, but also a high % of Pb, Cu and Zn oxides. More recent instances, of forest damage attributed to $SO_2$ from smelters are cited by White and Linzon (1950) and Linzon (1958) in Canada, Irmuk and Hus (1951) in Turkey, Wentzel (1956*a*, *b*) in W. Germany, Kurata and Hashimoto (1956) and Okanoue (1958) in Japan, and Mihailović and Krstić (1957) in the Bor basin, Serbia; further instances of damage attributed to $SO_2$ from sources other than smelting works are cited by Karlén and Tydén (1958), arising from the burning of shale residue as fuel in Sweden, and by Němec (1957) who reports damage to the forests round a paper-mill at Česka Kamenica, Czechoslovakia.

The damage caused by $SO_2$ to forest trees near the Washoe smelter, Anaconda, and in the Columbia River valley, Washington, south of the Trail smelter, has been described in some detail by Scheffer and Hedgcock (1955). Given in order of decreasing susceptibility to damage (as judged from the degree of foliage thinning at different distances from the smelter), the principal species affected on the Anaconda site were *Abies lasiocarpa*, *Pseudotsuga taxifolia*, *Pinus contorta*, *Picea engelmannii* and *Pinus ponderosa*. Trees of these species were dead or dying within a radius of 5 to 8 miles: damage to *A. lasiocarpa*, the most sensitive species, was evident up to 22 miles away. The techniques of growth-ring analysis, previously used, e.g. by Reuss (1893), Haselhoff and Lindau (1903), Gerlach (1910), Hedgcock (1912), Eicke (1914), and Toumey (1921), to demonstrate retardation of diameter growth in conifers by industrial fumes and smoke containing $SO_2$ as a primary constituent, were again applied to show that diameter growth of *A. lasiocarpa*, *Pseudotsuga taxifolia* and *Pinus contorta* had been, and was being, retarded. In addition, cones on surviving trees were to a large extent abortive, natural regeneration was limited, and areas denuded of trees were undergoing erosion. The seriousness of erosion originating in this way is emphasized in a report from Japan [Kurato and Hashimoto (1956)] dealing with attempts to control erosion round smelters (e.g. the copper smelter at Ashio, central Honshu) by planting species of, e.g. *Fraxinus*, *Quercus* and *Sasa*, tolerant of local pollution conditions.

Scheffer and Hedgcock's investigations (1955) in the upper Columbia River valley supplement those made previously on the same site by Katz *et al.* (1939). *Pinus ponderosa*, *Pseudotsuga taxifolia* and *Larix occidentalis* were the chief species of commercial interest in the area. According to Scheffer and Hedgcock, damage to these and other species could be detected up to 50 miles south of the Trail smelter. Their opinions as to the relative susceptibility of the various species to damage by $SO_2$ conflict with those of Katz *et al.* This could be expected in view of the different emphasis placed on various criteria used to judge susceptibility. For example, *L. occidentalis* could be classed as a species highly sensitive to $SO_2$ if the criterion applied were the readiness with which its foliage was damaged during the growing season; whereas on the basis of its resistance to ultimate killing, it could be classed, on account of its deciduous habit, as fairly tolerant to $SO_2$. In addition, one must bear in mind the difficulty of locating sites where species occur together under conditions permitting proper comparison of their intrinsic susceptibility to damage.

Lathe and McCallum (1939) and Scheffer and Hedgcock (1955) claimed that growth-ring analysis showed diameter growth of *Pinus ponderosa*, *P. contorta* and *Pseudotsuga taxifolia* to have been retarded in the years following those in which high concentrations of $SO_2$ were known to have been emitted from the Trail smelter; trees damaged by $SO_2$ failed to respond subsequently to periods of rainfall favourable for growth. According to Lathe and McCallum, the reduction in diameter increment was greater in *Pseudotsuga taxifolia* than in *Pinus ponderosa*, a difference attributed to the fact that the needles of the former species were shed more rapidly after damage. When normal growth became possible as pollution decreased, defoliated trees of *Pseudotsuga taxifolia* recovered more slowly than those of *Pinus ponderosa*, a difference attributed to the longer time taken by the former to replace its normal complement of leaves. Similar reports of reduced annual diameter increment, attributed to $SO_2$, are those of Karlén and Tydén (1958) for conifers on a Swedish site, and of Linzon (1958) for *Pinus strobus*, near Sudbury, Canada. Scheffer and Hedgcock (1955) reported that height growth of damaged trees of *Pinus ponderosa* was also retarded and cone production markedly reduced. Katz, Ledingham and McCallum (1939) considered the latter effect to be an indirect result of damage to foliage rather than a direct result of injury to reproductive organs by $SO_2$. This conclusion appears to need re-examination: it was based chiefly on the finding that the concentrations of $SO_2$ that Döpp

(1931) had shown to be necessary to damage pollen of *Pinus mugo* and *P. sylvestris*, greatly exceeded those recorded in the Trail area. However, no germination tests were carried out on pollen from trees in the latter area. Nor do the germination data of Katz, Ledingham and McCallum purporting to show the absence of a significant correlation between the viability of *Pinus ponderosa* seed and the distance of the parent trees from the pollution source, appear adequte to support the conclusion that $SO_2$ was without effect on the seed of this species. Katz, Ledingham and McCallum also failed to find field evidence of $SO_2$ damage to seedlings of *Pinus ponderosa* and *Pseudotsuga taxifolia*. Scheffer and Hedgcock (1955), however, using seedlings of these two species planted at different distances from the pollution source, reported that seedling mortality due to $SO_2$, as well as poor cone production, determined the extent of natural tree regeneration in the Trail area.

Chemical analysis of plants growing at different distances from, and along different axes through, the pollution source, has frequently been used as a survey method to define the actual and potential area of damage by specific pollutants. For $SO_2$, the method has involved establishing a relationship between distance from the pollution source and the foliar S content of various species, usually trees. That such a relationship exists has been claimed, e.g. by Schröder and Reuss (1883), Frazer (1907), Rusnov (1910), Haywood (1910), Cohen and Ruston (1925), Lorenz (1933), Fisher *et al.* (1927–30), Griffin *et al.* (1936), Katz and McCallum (1939), André and Hartig (1957) and Bieberdorf *et al.* (1958). The results obtained by this method of survey do not, however, always agree with those from field observation of visible damage to foliage. Wislicenus, in 1901, pointed out that high concentrations of $SO_2$ applied over short periods, could cause the death of a plant without increasing the S content of its leaves. Haselhoff and Lindau (1903), Tatlock and Thomson (1914), Haselhoff, Bredemann and Haselhoff (1932) and Katz and McCallum (1939) all asserted that the S content of leaves was not necessarily related to the degree of visible injury [cf. André and Hartig (1957) below]. Interpretation of the results of the chemical method of survey also involves consideration of factors, e.g. age, season and soil characteristics, that could influence the S content of leaves. While Bieberdorf *et al.* (1958) found no difference in the sulphate contents of 1- and 2-year-old needles of *Pinus taeda*, Katz *et al.* (1939) found that the foliar S content of *Pseudotsuga taxifolia* and *Pinus ponderosa* trees in the Trail area was related to needle age: the oldest contained most S but the rate of S accumulation was higher in young needles. The S content increased during summer but scarcely or not at all during winter, despite the higher concentrations of $SO_2$ then prevailing in the atmosphere. They also found that the S content of the needles decreased progressively with increasing altitude of site. Jahnel (1954/1955) commented that the proportion of late wood in annual rings frequently declined after $SO_2$ injury to the leaves.

It will be apparent that satisfactory use of the chemical method of survey can only be made after locating trees of similar age on sites similar in all respects save that of the atmospheric concentration of the pollutant in question, and after careful consideration of the time and manner of leaf sampling. André and Hartig (1957), appreciating the difficulties that have made leaf analysis an unsatisfactory method for appraising pollution damage, endeavoured to eliminate some of the variables. In a first report, they described the exposure of barytes-impregnated paper strips above and within the canopy of a Spruce forest, the sites being spaced 100 m. apart along a line from the pollution source in the direction of the prevailing winds. They found the S content of needles (divided into age-groups), and of the air, to be consistently less within than above the canopy. Deducing from this that the tallest trees were most likely to suffer injury from $SO_2$, they suggested that these might be the first to be considered for felling. By 'within-tree' sampling of needles by age groups, they also found that the S content of the needles increased with their age. Graphs of S content against age of needles from a severely injured, a moderately injured and a healthy tree, gave nearly straight lines of different slope for the trees in question. André and Hartig concluded that the magnitude of the difference between the S contents of 1-year-old and 5-year-old needles could be taken as an indication of the extent of $SO_2$ injury.

Periodic sampling and analysis of leaves of comparable age from even-aged plants (trees), previously transplanted in similar soil to appropriate sites about the pollution source would appear to be a more satisfactory field survey method. The test plants may be those that field observations suggest are sensitive to local pollution conditions; or they may be species that have been previously shown, by fumigation experiments with specific pollutants under controlled environmental conditions, to be sensitive to the particular pollutant suspected of causing damge. Adams *et al.* (1956*b*), for example, used this approach to survey damage to *Pinus ponderosa* forest caused by F compounds, supplementing chemical analyses of the transplant material by a quantitative assessment (using an 'injury-index' method) of the extent of leaf damage.

There remains the necessity for confirming experimentally, under controlled conditions, that any suspected pollutant, when applied in concentrations comparable with those found to damage a given species in the field, produces in it symptoms of damage and changes in chemical composition identical with these field symptoms. This has involved fumigation of test plants with known concentrations of specific pollutants either in the field (using a portable cabinet), or in greenhouses, or in the controlled environment of growth cabinets or a phytotron. Experiments with $SO_2$, using trees or shrubs as test plants, were conducted by Stockhardt, Reuss and other early investigators [see Haselhoff and Lindau (1903), Wieler (1902, 1933*a*, 1933*b*), Haywood (1905, 1910), Wislicenus (1901, 1918), Holmes, Franklin and Gould (1915), Beran and Reckendorfer (1931), Katz *et al.* (1939)—results summarized by Katz (1949), Scheffer and Hedgcock (1955), Darley (1956), and Zimmermann and Hitchcock (1956)]. Keller (1958) recently described experiments on the gas exchange of conifers under the influence of fairly high concentrations of $SO_2$ (4–6 mg./cu.m. air) over short periods. In addition, numerous fumigation experiments have been made on species other than woody perennials [see, e.g. Zimmermann and Crocker (1934), Thomas and Hill (1937), Setterstrom (1940) and Metcalfe (1941)]. Questions as to whether repeated or continuous fumigations are to be employed, and over what period, are difficult ones. Such questions have arisen, not in attempts to duplicate symptoms of damage observed in the field, but when the bogey—from the industrialists' point of view [see Swain's comments (1923)]—of 'invisible injury' has been raised. The concept of 'invisible injury', attributed to Stoklasa (1923)—i.e. injury arising from the cumulative effect of metabolic disturbances caused by the prolonged action of $SO_2$ at concentrations lower than those producing visible leaf lesions—has been severely criticized by Katz (1949) and by Thomas (1951). This criticism was based on the results of studies [Katz (1949); Swain and Johnson (1936); Thomas *et al.* (1943, 1944); Thomas, Hendricks and Hill (1944); Setterstrom and Zimmermann (1939)] on the yield, chemical composition and $CO_2$ assimilation of (herbaceous) plants fumigated with concentrations of $SO_2$ usually $< 1{\cdot}00$ p.p.m. Bleasdale (1952), however, recently re-opened the question by obtaining reductions in yield of S23 ryegrass in a greenhouse receiving unfiltered Manchester (England) air compared with ryegrass grown in filtered air. In considering the results of experiments of this type, the difficulty of filtering out all air pollutants, other than $SO_2$, from city air, must be appreciated. No critical experiments appear to have been made on the possibility of 'invisible injury' to trees, though Katz (1952) reported instances at Trail of trees, otherwise healthy looking, gradually losing their normal needle complement. However, despite the importance of the time and extent of premature leaf abscission in trees as a symptom of pollution damage, quantitative use of this criterion does not appear to have been made in either field or fumigation experiments. Thus, while Katz and McCallum (1952) found that injurious $SO_2$ concentrations exercised a considerable residual effect—trees with a high % of injured leaves having only scanty foliage 3 years after relief from exposure—no estimates of abscission rates of visibly injured and uninjured leaves were made. This points to the necessity, when considering 'invisible injury', of first defining the term—whether it implies reduced yield, or less flowering, or altered chemical composition, or increased rate of leaf abscission, or some other effect. The notion of 'invisible injury' is essentially negative: it could be upheld, in the face of evidence refuting certain of its claims, merely by altering the criterion of 'invisible injury'. Further polemics over the question appear to merit little consideration: the effects produced by $SO_2$ on any species should be considered objectively.

Katz *et al.* (1939) [results summarized by Katz (1949) and Katz and McCallum (1952)] carried out fumigation experiments on conifers aged up to 25–30 years in their natural habitat ($SO_2$ at 0·25–5·00 p.p.m.), on transplanted conifers 3–10 years old ($SO_2$ at 0·15–5·32 p.p.m.), and on conifer seedlings 1–3 years old in nursery rows. Transplanted conifers grown on irrigated plots proved more susceptible to $SO_2$ than conifers of the same age in their natural habitat. The S content of the needles under either condition was said to bear no relation to the extent of injury to the trees after fumigation. Rate of absorption was regarded as a more important factor in determining extent of injury than the actual amount of $SO_2$ accumulated in the foliage. But, while Katz *et al.* indicate that rate of $SO_2$ absorption is a function of its concentration in the air, of the duration of the treatment, of environmental conditions such as humidity, and of season of the year, the way in which these variables were manipulated in the fumigation experiments is perplexing. Conifers under both natural and transplant conditions proved more susceptible to $SO_2$ in spring and early summer than in autumn or winter, the deciduous *Larix occidentalis* particularly so. Rate of height growth of *Pseudotsuga taxifolia* was retarded more than that of *Pinus ponderosa* when the degree of foliage injury (20–100%) was similar. In experiments with seedlings of the two species, younger seedlings were more easily injured than older ones, when fumigated for 8 or 9 hours with $SO_2$ concentrations of 0·50–0·78 p.p.m. Scheffer and Hedgcock (1955), using transplants of various shrubs and conifers, carried out fumigation experiments with two concentrations of $SO_2$, ca. 0·50 and 1·00 p.p.m. With the latter concentration, all species showed injury in $< 7$ hours, but only those that field observation had suggested were most sensitive, e.g. *Physocarpus capitatus* and *Larix occidentalis*, were injured after fumigation for a similar period with 0·50 p.p.m. Scheffer and Hedgcock agreed with Katz *et al.* that $SO_2$ concentrations $> 0·25$ p.p.m. (which Katz *et al.* had maintained for 450 hours over *Pinus ponderosa* and *Pseudotsuga taxifolia*—age not stated—without causing injury) would be necessary to injure these species.

Zimmermann and Hitchcock (1956) fumigated, in portable greenhouses and stationary cabinets, a large number of plant species, including several woody perennials, with either $SO_2$ (0·1–1·0 p.p.m. in various experiments) or HF (0·001–0·1 p.p.m. in various experiments). The intention was to compare the relative susceptibilities of these species to the two gases. The periods of exposure were usually 2 to 8 hours with $SO_2$ and 6 to 8 days with HF. At given concentrations and periods of exposure, species found susceptible to damage by HF were not necessarily also damaged by $SO_2$ and *vice versa*. Some species were equally resistant, some equally susceptible, to damage by either gas. Darley, Middleton and Kendrick (1956) found plants of sweet orange more sensitive than those of sour orange (age not stated) to fumigation with $SO_2$ concentrations of either 2·5 or 6·5 p.p.m. for 2–6 hours, under controlled conditions of 72° F. and 84% relative humidity.

Regarding the possibility that $SO_2$ might have an indirect effect upon plants by acting upon soils, Zieger (1954/1955) agreed with early opinions—e.g. of Haselhoff and Lindau (1903) and Widstoe (1903)—that alteration in soil characteristics such as pH, can be expected only after long exposure to relatively high concentrations of $SO_2$. In the Trail area, for example, Kate, Wyatt & Atkinson (1939) found the increased acidity, decreased base saturation and increased $SO_4$ content, of soils of low buffer capacity, to be limited to an area within 10 miles of the smelter.

[*Part II* (*and bibliography*) *will appear in next number*.]

# ABSTRACT SECTION

## 0. FORESTS, FORESTRY, AND THE UTILIZATION OF FOREST PRODUCTS: GENERAL

For general *regional* accounts see section 90

### Translations

See Nos. 2649, 3776, 3893.

### 0 (038). Dictionaries. Encyclopaedias

2617. Naučný slovník lesnický. II. **[Forestry encyclopaedia. Part II.]** Československá Akademie Zemědělských Věd, Prague. 1959. pp. 709–1677. [Cz.] Price *Kčs*. 157. I.F.B.

Part II covers J to Q. [Cf. *F.A.* 20 No. 4032.]

### 0 (048.1). Bibliographical Lists

See also Nos. 2631, 3344, 3631, 3918.

2618. BENDA, P., and KLICPEROVÁ, J. Československá lesnická bibliografie do roku 1933, díl III/2. **[Czechoslovak forestry bibliography [from 1924] to 1933. Part III/2.]** Výzkumný Ústav Lesního Hospodářství, Zbraslav-Strnady. 1958. pp. 29 + [2]. 789 refs. [Cz.]

Lists 789 titles, arranged under the Oxford Decimal Classification. There is also an author index.

2619. Bibliographie der forstlichen Literatur der Schweiz, 1954–1957. **[Bibliography of Swiss forestry literature, 1954–57.]** Schweizerische Anstalt für das forstliche Versuchswesen, Birmensdorf, Zurich. 1959. pp. 81.

Future titles of the Swiss Forestry Bibliography will appear in the *Bibliographia scientiae naturalis Helvetica* published by the Swiss National Library, Berne.

2620. Raboty, opublikovannye v resul'tate pjatiletnih issledovanij Džanybekskogo stacionara. **[Works published from 1925 to 1955 on the investigations at the Dzhanybek Station.]** *Trud. Inst. Les.* No. 38, 1958 (205–7). 44 refs. [Russ.]

Arranged alphabetically by authors.

### 0 (05). Periodicals

2621. 30 Jahre *Forstarchiv*. Register für Jahrgänge 1925–1944 und 1950–1959. **[Thirty-years' Index for volumes 1925–44 and 1950–59 of *Forstarchiv*.]** *Forstarchiv* 31 (1/2), 1960 (I–XXXIX). [G.]

Includes a classified list (O.D.C.) of original papers, review articles, etc. and an alphabetical author index including both contributors and the authors of books and papers reviewed.

### 0 (084.3/4). Maps. Atlases

See also Nos. 2922, 2929.

2622. **[Swiss forestry maps.]** Eidg. Anstalt für das forstliche Versuchswesen, Birmensdorf. [1959?] 6 maps. [G.]

Six small-scale maps covering the whole country and showing % forest area, ownership, size of forests, % of coniferous forest, production, etc.

2623. Carte des sols et de la végétation du Congo Belge et du Ruanda-Urundi. 9. Région d'Élisabethville (Haut-Katanga). A.—Sols. B.—Végétation. C.—Utilisation des sols. **[Map of the soils and vegetation of the Belgian Congo and Ruanda-Urundi. 9. Élisabethville region (Haut Katanga). A.—Soils. B.—Vegetation. C.—Land use.]** Institut National pour l'Étude Agronomique du Congo Belge (I.N.É.A.C.), Brussels. 1959. pp. 70 + 6 photos + 4 maps. [F.]

Consists of an explanatory booklet (*C. Sys* and *A. Schmitz*), the soil, vegetation and land-use maps (scale 1 : 60,000) and a detailed vegetation map of the area south of Élisabethville (scale 1 : 25,000).

### 0 - - 010. Research Technique

2624. KLEMM, W. Die Anwendung radioaktiver Isotope in der Forstwissenschaft. **[The use of radioactive isotopes in forestry.]** *Arch. Forstw.* 8 (8), 1959 (726–42). 41 refs. [G.]

A review with special reference to German and Russian literature, covering physiology (including the role of micro-organisms in the rhizosphere, transpiration, assimilation, and flowering), chemistry (including resin and lignin), anatomy and morphology, pathology and protection (Oak wilt, dieback of *Betula lutea*, mistletoe, insects), breeding (including tolerance), and utilization (barking, preservation, defects, etc.).

### 0 - - 011. Terminology. Nomenclature

See No. 2617.

### 0 - - 015. Mathematical and Statistical Methods

2625. JEFFERS, J. N. R. **Experimental design in forest research.** International Union of Forest Research Organisations. (Obtainable from Almquist & Wiksell, Stockholm.) 1959. pp. 172. 35 refs.

A description of the more important designs and analyses used, explaining when and why they are used, with worked examples from experiments of the Research Branch of the Forestry Commission, Great Britain. French and German equivalents of some 150 statistical terms are given. [Cf. *F.A.* 14 No. 933.]

# 1. FACTORS OF THE ENVIRONMENT. BIOLOGY

## 11. Site Factors: Climate, Situation, Soil, Hydrology (Water Conservation, Soil Conservation and Erosion)

### 111.1. Composition, Structure, Mechanics and Thermodynamics of the Atmosphere in General

See also Nos. 3269–70.

2626. Gligić, V. Ispitivanje $CO_2$ režima nekih staništa na Igmanu i Bjelašnici. **[Investigation of the $CO_2$ regime of some sites in the Igman and Bjelašnica Mts.]** *Rad. Poljoprivred.-Šum. Fak., Sarajevo* (*Šum.*) 2 (2), 1957 (3–11). 8 refs. [Croat.g.]

Measurements over May–Oct. 1955 showed that the $CO_2$ concentration of the air generally decreased with increasing height above the ground. Just above ground level, and at 2 m. and 4 m. in a Pine/Silver-Fir/Spruce forest (1300 m. alt.), $CO_2$ content was 158, 93·5 and 47 mg./litre respectively, and in a Beech/Silver-Fir/Spruce forest (1460 m. alt.) 132, 84·5 and 58 mg./litre.

### 111.2. Radiation and Temperature

See also Nos. 2676, 2830.

2627. Richardson, S. D. **The use of a spherical radiation meter in woodlands.** *Forestry* 32 (2), 1959 (126–37 + 1 photo). 29 refs.

[Cf. *F.A.* 17 No. 1119.] For measurements of the light climate in woodlands, conventional light meters have a limited usefulness. The flat light-receiving surface results in preferential sensitivity to radiation incident in a direction normal to the surface, while barrier-layer cells vary in sensitivity according to the light wave length, and cannot at present be accurately calibrated to characterize the spectral variation under a tree canopy. A new type of radiation meter, designed by E. C. Wassink and C. van der Scheer, and comprising two photocells with hemispherical covers, was compared with a flat meter in several woodland environments. It is shown to be less sensitive than the flat meter to changes in direction of light influx, and more sensitive to changes in light intensity due to cover type and ground vegetation. The influence of ground vegetation on the light intensity above it is assumed to be due to differences in light reflection by different vegetation types. It is suggested that under a tree canopy the measurement of light influx is of more value to the forester than an estimate of illumination at a surface, and that, when barrier-layer cells are calibrated for use in woodlands, the emission spectrum of the standard light source should conform to the spectral curve of photosynthesis. *From author's summary.*

2628. Jeník, J., and Kosina, Z. Thermistorový teploměr pro potřeby fytoekologie. **[A thermistor for plant-ecological purposes.]** *Preslia* 32 (1), 1960 (69–78). 19 refs. [Cz.cz.g.] E.M.B.

[Cf. *F.A.* 21 No. 1312.] Describes a thermistor designed by the authors which has an accuracy of ± 0·1° C.

### 111.8. Climatology. Climate and Microclimate

See also Nos. 2633, 2896, 2936, 2973, 3092, 3174, 3439–40, 3507, 3551.

2629. Wilusz, Z. Wpływ ściany lasu na mikroklimat przyległych pól. **[The influence of the forest margin on the microclimate of adjacent fields.]** *Arboretum Kórnickie, Poznan* No. 4, 1959 (285–306). 8 refs. [Pol.russ.e.*e*.]

Investigates the influence of a square block of forest (2·25 ha.; 60–120 years old; Birch/Oak/Robinia/Spruce) on the microclimate of surrounding fields on sandy soil over clay. Following Tomanek's method [cf. *F.A.* 14 No. 2975] the minimum temperature, evaporation, snow cover, soil thawing, and wind velocity were measured at points 5 m. from middle of the N.E., N.W., S.E. and S.W. margins of the stand, in the middle of the stand, and 300 m. S. of it. Results were generally the same as in Tomanek's work, but there were some slight differences, e.g. in the quantitative distribution of precipitation. The beneficial influence of the block on field microclimate was clearly established; further investigations are required only to ascertain how far it extends into the field.

2630. Intribus, R. Príspevok k mikroklíme spustnutých pôd na Slovensku. **[The microclimate of wastelands in Slovakia.]** *Lesn. Čas.* 6 (1), 1960 (32–53). 12 refs. [Slovak.russ.g.]

Compares conditions (air and soil temperatures, evaporation, r.h., wind speed) on areas in the S. Slovakian karst where extensive grazing is practised, with those on afforested areas where grazing has been stopped. Results indicate that only closed stands can provide proper soil protection, and that grazing must be excluded to make afforestation possible.

## 114. Soil. Soil Science

### 114.1. Soil Physics

See also Nos. 2649–50, 2660, 2674–7, 2841.

2631. Shaw, M. D., and Arble, W. C. **Bibliography on methods for determining soil moisture.** *Engineering Research Bulletin, College of Engineering and Architecture, University Park, Pennsylvania* No. *B*78, 1959. pp. v + 152.

Contains 629 references to technical papers and patents, with short abstracts, listed under the principal methods: chemical, electrical, gravimetric, lysimeter, nuclear, penetrometer, tension, thermal, and miscellaneous. *From authors' summary.*

2632. **[Soil moisture measurement by liquid nitrogen probe.]** *Extr.* from *Rep. Sth. For. Exp. Sta. 1958*, 1959 (12).

Hollow probes of various designs were inserted into the soil and filled with liquid N in order to cause some of the soil to freeze to the outside of the probe, with which it could be lifted out and its m.c. determined gravimetrically. Laboratory studies in silt and sandy loam have shown that the method can be used in a moisture range from 2 to 175% by weight.

2633. KUŹNIAR, K. Kształtowanie się wilgotności gleby leśnej i uprawnej w zależności od niektórych czynników ekologicznych. **[Influence of some ecological factors on the moisture percentage in forest and cultivated soil.]** *Ekologia Polska, Warszawa* 7*A* (6), 1959 (169–87 + 13 gphs., 5 tbls.). 6 refs. [Pol.*e.e.*] Price *Zl.*18. O.R.S.

Presents results of a study in 1954–58 in an old Oak/Pine forest, a young Pine forest and a cultivated field. Factors investigated included rainfall, air temperature, soil temperature and air humidity. *From author's summary.*

2634. BIRJUKOV, N. S. Materialy k harakteristike gidrologičeskih uslovij territorii Kadnikovskogo lesničestva Vologodskoj oblasti. **[The hydrological conditions in Kadnikov forest district, Vologda region.]** *Soobšč. Inst. Les.* No. 12, 1959 (27–39). 1 ref. [Russ.]

Tabulates data on the structure, physical properties, and variations in water-table levels of clay-loam soils on five sites: (1) a 7-year-old clear felling in the *Piceetum herboso-hylocomiosum*, regenerating naturally with broadleaved species; (2) a Spruce/Birch stand 18 years old; (3) as (2), 37 years old; (4) *Piceetum herboso-hylocomiosum*, 110 years old; (5) as (4), 135 years old. It is concluded that there is a general tendency towards waterlogging throughout the area, and that drainage is desirable.

2635. POL'SKIJ, M. N. Vodnyj režim celinnyh i melioriruemyh solončakovyh soloncov. **[The moisture regime of virgin solonchak soils of the solonetz complex, and of those under reclamation.]** *Trud. Inst. Les.* No. 38, 1958 (73–82). 4 refs. [Russ.]

Shows how deep ploughing (40–50 cm.) and extra moisture (from snow accumulation by means of shelterbelts) basically improve the moisture regime of the soils being reclaimed, as compared with the virgin soil.

2636. STEARNS, F. **Soil temperature and moisture regimes of forest and field sites near Vicksburg, Mississippi.** *Abstr.* in *Bull. Ecol. Soc. Amer.* 40 (3), 1959 (72–3). A.P.B.

Temperature and moisture regimes of the upper foot of a silt-loam soil were studied in connexion with the development of a system for estimation of soil moisture. About the same amount of water was held under both hardwood forest and abandoned field. The field soil dried rather more than the forest soil in the 0- to 6-in. layer, and the forest soil more in the 6- to 12-in. layer. Moisture loss rate varied by season and between sites for each season. Onset of seasonal changes varied markedly between forest and field, and was related to differences in phenology and microclimate. The field soil usually began rapid depletion earlier in the spring and ceased earlier in the autumn than the forest. Soil moisture and temperature differences were evident between neighbouring plots in the forest; variation in surface microclimate caused by tree and shrub position was apparently responsible.

2637. DOUGLASS, J. E. **Soil moisture distribution between trees in a thinned Loblolly Pine plantation.** *J. For.* 58 (3), 1960 (221–2).

Soil samples were collected (*a*) at the end of the first growing season, and (*b*) at the beginning and (*c*) at the end of the second growing season after thinning [to 20 ft.?] in a 16-year *Pinus taeda* plantation near Union, S.C. The surface 4 ft. was sampled at 2-ft. intervals along a line between 2 trees, using 6 pairs of trees. Soil moisture (in % by weight converted into inches of available water) was fairly evenly distributed at (*b*), but at (*a*) and (*c*) was highest midway between trees and lowest adjacent to trees. At (*a*) this difference in m.c., 3 in., was significant at the 5% level, and at (*b*), 2 in., at the 1% level. In an adjacent unthinned plantation, m.c. between trees remained relatively constant. These observations illustrate a limitation of random sampling methods for determining soil moisture.

2638. STEINBRENNER, E. C. **A portable air permeameter for forest soils.** *Proc. Soil Sci. Soc. Amer.* 23 (6), 1959 (478–81). 10 refs.

Describes an instrument developed to measure macroscopic pore space directly in the field, and its calibration. Data relating surface-soil macroporosity to the growth of Douglas Fir seedlings on recently logged areas, and subsoil macroporosity to Douglas Fir site index are discussed.

2639. ROMANS, J. C. C. **Some measurements of air space in Scottish soils.** *J. Soil Sci.* 10 (2), 1959 (201–14). 3 refs.

Investigates the relation between soil air space and the hydrological sequence of soils, with tabulated data, including some for wooded land, and some for indurated layers in the holes left by fallen trees after a gale.

## 114.2. Soil Chemistry

See also Nos. 2642–7, 2649–50, 2652–5, 2850–2, 2862, 3106, 3163, 3171–3.

2640. SHAW, K. **Determination of organic carbon in soil and plant material.** *J. Soil Sci.* 10 (2), 1959 (316–26). 9 refs.

Describes a wet-oxidation technique for determining organic C in soil, plant material and aqueous plant extracts. The results of some tests are tabulated.

2641. TAMM, C. O., and ÖSTLUND, H. G. **Radiocarbon dating of soil humus.** *Nature, Lond.* 185 (4714), 1960 (706–7). 3 refs.

The radiocarbon dating method opens a way to determine the approximate 'time of residence' in the soil of the organic matter, supposing that this time is of the order of ⩾ 100 years. Three soil samples from a profile in Dalarna Province of Sweden have been studied; the sample plot was a vigorous 95-year Spruce forest on moraine, at 200 m. alt. The samples represented the mor layer ($A_0$), the leached but humus-coloured top horizon of the mineral soil ($A_1$), and the brown accumulation horizon (B). Considering that the site sampled has probably been covered with forest for ca. 9000 years, the relatively low age of the organic matter in the B horizon suggests that the organic matter in this horizon (or a considerable part of it) is continually broken down and resynthesized from substances coming from above. This is important, because in this and many other forest soil profiles the amount of organic matter in the B horizon equals or exceeds that in the A horizon.

### 114.3. Soil Formation. The Soil Profile and its Development. Litter, Humus, etc.

See also Nos. 2641, 2649, 2674, 3107, 3131, 3173, 3514.

2642. Cope, F. **Catchment salting in Victoria**. Soil Conservation Authority of Victoria, Melbourne. No. *T.S.* 1, 1958. pp. 88. 11 refs.

Discusses causes of local accumulation of salt in soils under natural rainfall conditions, and their importance in Victoria. A contributory factor was the clearing of forest and shrubs, which have a higher water consumption than grasses, from slopes in catchments where the rain contained salt from sea water (cyclic salt). In central Victoria, Cl contents of topsoils on cleared slopes were found to be markedly less than on comparable forested slopes. Increased run-off and leaching caused salting-up of flats below the cleared slopes, with resultant loss of vegetation and erosion, while little or no salting was found below slopes carrying their original cover. Lists of suitable trees for slopes and for areas already highly saline are given. Drainage and pasture improvement are discussed, including detailed experiments with fertilizers, soil improvers, and some 60 species of grasses and legumes.

2643. ***Pinus pinaster* studies**. *Extr.* from *Rep. For. Dep. W. Aust. 1958/59*, 1959 (33).

A series of profiles sampled from the groundwater podzol soil type at Gnangara, under *P. pinaster* plantations of different ages, from virgin soil up to 25-year-old plantations, showed that the present practice of clearing, cultivating, and planting *P. pinaster* has had a marked effect on the soils. There was a decline in organic matter, K, P, and exchangeable cations for at least 16 years after planting. In older plantations these properties slightly improved owing to litter fall.

2644. Mařan, B. Degradacija lesnyh počv v Čehoslovakii. [**Degradation of forest soils in Czechoslovakia**.] *Vestn. sel'.-hoz. Nauki, Moskva* 4 (10), 1959 (87–100). [Russ.e.g.f.] O.W.

Discusses tabulated data on the changes in soil moisture content, and the physical and chemical properties of forest soils in Czechoslovakia as affected by the change-over from deciduous and mixed to pure coniferous forests, and also the damage caused by wind, snow and insects to the latter. Accelerated podzolization occurs in the pure coniferous stands, and it is estimated that there are 400,000 ha. of degraded soil under Pine and Spruce in Czechoslovakia; some 80,000–100,000 ha. of this area are so degraded that the soil cannot be improved by establishing mixed stands, but will need other ameliorative measures. The special problems of soils with a limonite layer or poisoned by industrial wastes and smoke are also discussed.

2645. Sjörs, H. **Changes in pH of leaf litter during a field experiment**. *Oikos* 10 (2), 1959 (225–32). 19 refs. [E.e.]

Fresh litter of 11 broadleaved species, obtained by shaking trees in late October, was placed on the soil for 34 days, and the pH of water extracts determined at intervals. A rise in pH was found in all species except *Acer platanoides*, in which the rise was likely to occur in the following year. It is probably caused by the destruction or transformation of organic anions. Low-temperature, natural leaching occurring during the experiment, and the acid substances that begin to form, made the increase in pH moderate and irregular. *From author's summary*.

2646. Nykvist, N. **Leaching and decomposition of litter. I. Experiments on leaf litter of *Fraxinus excelsior*. II. Experiments on needle litter of *Pinus silvestris*.** *Oikos* 10 (2), 1959 (191–224). 56 refs. [E.e.]

(I) A study was made of the factors influencing the leaching of *F. excelsior* leaf litter, and the changes in acidity taking place in the litter under (*a*) anaerobic and (*b*) aerobic conditions. A concurrent study was made of decomposition during the first 40 days of leaching. It was found that two different kinds of water-soluble substances can be leached from the litter—those present in fresh litter, and those produced on its decomposition. The former were easily leached, reducing the dry weight of the litter by 22% in 24 hours. This leaching is apparently independent of micro-organisms. The quantity of water-soluble decomposition substances was less. The pH of the litter depended on the air supply during leaching, and on the duration of leaching. In (*b*) conditions, the pH rose considerably, but in (*a*) a slight fall took place. During the first 7 days, the decomposition of litter was great under both (*a*) and (*b*) conditions. Thereafter, (*a*) decomposition was small. The decomposition of previously leached litter was small during the first 14 days. After 42 days, (*b*) decomposition was about twice that of (*a*). In (*a*) leaching, the gas pressure fell during the first 26 hours, probably owing to absorption of C; thereafter it rose, vigorous evolution of gas continuing for ca. 3 days. (II) In corresponding experiments on *Pinus sylvestris* needle litter, it was found that the amount of water-soluble organic substances obtained after 24 hours of (*a*) leaching was < 1% of litter dry weight and after 43 days ca. 3% only. The amounts of organic and inorganic substances leached in (*b*) conditions were even less. The pH value rose during (*b*) decomposition of the litter; (*a*) decomposition was initially fairly rapid, but became slow after a week. In (*b*) conditions, the rate of decomposition during the first week was the same as in (*a*) conditions, but after 43 days about twice as great. Leaching of Pine litter for 24 hours twice before the experiment did not bring a decrease in decomposition, whereas

*F. excelsior* litter previously leached thrice showed considerably less decomposition than fresh litter. In (*a*) leaching, the gas pressure fell initially, even in sterilized samples; a subsequent rise was observed only in unsterilized samples, indicating that this was due to microbiological processes.

2647. Schnitzer, M. **Interaction of iron with rainfall leachates.** *J. Soil Sci.* 10 (2), 1959 (301–8). 11 refs.

[Cf. *F.A.* 17 No. 31.] Leachates from decomposing leaves of *Fagus grandifolia*, *Betula populifolia*, *Acer saccharum*, *A. saccharum* + *A. rubrum*, and *Populus grandidentata* were collected after each rainfall for the period May–Sept. Determinations were made of the capacity of these leachates to take up Fe from Fe-saturated Dowex-50, and to withhold this Fe from exchange and/or adsorption by exchange resins saturated with H, Al, Ca, and Mn. For both characteristics the leachates ranked Maple > Poplar > Birch > Beech. The capacity of ion-saturated resins to remove Fe from Fe-enriched leachates was H > Al > Ca = Mn. This behaviour may be related to the variable thickness of the horizons of eluviation and deposition of Fe in various podzolic soils. Apparant pK values of metal-free leachates ranged from 3·6 to 3·9, and those of Fe-enriched leachates from 4·7 to 5·0, except Poplar (3·80). *From author's summary.*

2648. Lull, H. W. **Humus depth in the Northeast.** *J. For.* 57 (12), 1959 (905–9). 18 refs.

Mean humus depths in mature forest (⅔ of the commercial forest area of the northeastern U.S.A.) and in young plantations (⅓ of the forest area) were respectively 1 and 3 in. less than the potential depth suggested by measurements in 18 virgin stands of conifers or hardwoods. Depth in pure Spruce stands, which are now disappearing, was much greater than elsewhere.

### 114.4. Soil Classification. Soil Types

See also Nos. 2623, 2642.

2649. Gerasimov, I. P. **Gleyey pseudo-podzols of Central Europe and the formation of binary surface deposits.** *Soils & Fertil.* 23 (1), 1960 (1–7). 16 refs. Transl. by N. Watts from *Izvestija Akademii Nauk SSSR, Moskva* (*Serija Geografičeskaja*) 1959 (3), (20–30).

Discusses the roles of *lessivage* or 'illimerization' (formation of a binary soil profile through downward movement of the clay fraction without decomposition) and gleying, in determining the formation and nature of the *sols lessivés* and 'pseudogleys' of western Europe and some probable analogues in White Russia, Transcarpathian Ukraine, Rumania and Jugoslavia, now recognized as distinct from the true podzols (in which the clay fraction is subject to decomposition). The term 'gleyey pseudo-podzols' is suggested for such soils, which may be formed not only under forest but also under grassland or on arable land. Gleying in the pseudo-podzols is more intense in winter, under the milder climate of W. and Central Europe, when true podzols are frozen hard. The hypothesis is put forward that the binary surface deposits on the plains of central Europe developed from periglacial calcareous deposits in which, with the change to a warmer, more humid climate, the leaching of lime was accompanied by some dispersion and leaching of clay material from the surface horizons.

2650. Fridland, V. M. Vertikal′naja zonal′nost′ počv v Severnom V′etname. **[Vertical zonation of soils in N. Vietnam.]** *Počvoved.* 1959 (11), (8–18). 10 refs. [Russ.e.] A.P.B.

Mechanical and chemical analyses of lateritic soils, mainly under secondary evergreen broadleaved forest. The humus content, C/N ratio, and the base exchange capacity of the clay fraction increase with increasing altitude; the colour of the soils also changes from red to yellow or even white.

2651. Lobova, E. V. O počvah Gany. **[The soils of Ghana.]** *Počvoved.* 1960 (1), (47–55). 17 refs. [Russ.e.] A.P.B.

On the basis of papers given at the 7th International Conference of W. African Countries, and other literature and observations, the characteristics are described of (1) soils of the lateritic group under evergreen tropical rain-forest, (2) laterite soils with surplus moisture, (3) black tropical soils. The author suggests dividing (3) into automorphic and hydromorphic soils.

### 114.5. Soil Fertility. Soil Toxicity. Soil Depletion and Exhaustion

See also Nos. 2644, 2843, 2900, 2924, 3129 *et seq.*, 3556, 3163.

2652. Smoljak, L. P., and Boiko, A. V. Kuivendatud metsamuldade toitumisrežiimist. **[The nutrient regime of drained forest soils.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 80–94. 12 refs. [Est.russ.g.]

Tabulates data on mineral nutrient contents for soils of raised bogs, transitional bogs and fens.

2653. Masing, V. Taimed soometsade kasvukohatingimuste näitajatena. **[Plants as indicators of site conditions in forests with a high water-table.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 114–9. 4 refs. [Est.russ.g.]

Lists mosses indicating various nutrient and water regimes in peat soils, and also pH indicator plants.

2654. Marel, H. W. van der. **Determination of P status of *Hevea brasiliensis* by bark analysis.** *Plant & Soil* 12 (1), 1960 (5–16). 53 refs.

It was found that P analysis of *Hevea* barks can better represent the amount of available P in the soil than soil analysis. Bark analyses are also less markedly influenced by date of sampling than leaf analyses.

### 114.6. Soil Biology

See also Nos. 2848, 3132, 3354, 3424.

2655. Moreau, R., and Schaeffer, R. Défense et illustration . . . de la microbiologie forestière.

**[Defence and illustration of forest microbiology.]** *Rev. for. franç.* 12 (3), 1960 (177–80). 7 refs. [F.]

Controverts some of the views of Duchaufour and Rousseau on the toxic effects of Mn on *Abies alba* regeneration [cf. *F.A.* 21 No. 1927], claiming that, at any rate in the Jura, many microbiological factors are involved in its failure [cf. *F.A.* 21 Nos. 1348–9].

2656. Nicot, J. Un aperçu de la microflore fongique du sol des Bois des Rièges (Camargue). **[The fungus microflora of the soil of the Bois des Rièges (Camargue).]** *Ann. Sci. nat.* (*Bot.*) 19, 1958 (203–9). 3 refs. [F.] O.B.D.

Presents the results of an investigation into fungi found in surface soil samples from the only homogeneous forest of *Juniperus phoenicea* in France.

2657. Ivarson, K. C., and Katznelson, H. **Studies on the rhizosphere microflora of Yellow Birch [*Betula lutea*] seedlings.** *Plant & Soil* 12 (1), 1960 (30–40). 29 refs.

Studied in a forest soil in tanks in the greenhouse, the rhizosphere effect of Yellow Birch roots in the A horizon was generally lower than that observed with cropped plants; nevertheless, a stimulation of microbial development was obtained. Of the micro-organisms studied, bacteria and ammonifying and methylene-blue-reducing organisms appeared to be predominant types in the root zone. Counts were, on the whole, lowest when plants broke dormancy, and began to increase in the later periods of growth. There was no appreciable difference between control and rhizosphere soils in the incidence of specific nutritional types of bacteria. Analysis of the rhizosphere population of roots growing in the B horizon showed a distinctly greater rhizosphere effect than that obtained in the A horizon. The data suggest that the rhizosphere effect in the latter was obscured because of its high organic-matter content and its abundant and active microflora. *From authors' summary.*

2658. Zamith, A. P. Leme, and Lordello, L. G. E. Algumas observações sôbre nematódeos em solo de mata e em solo cultivado. **[Nematodes in forest and cultivated soils.]** *Rev. Agric., Piracicaba* 32 (3), 1957 (183–8). 3 refs. [Port.e.] A.P.B.

Lists nematodes collected on a number of forest plots, both natural and artificial, at Piracicaba and Ribeiro Prêto (São Paulo), and compares them with collections from various agricultural and horticultural soils. The nematode fauna from forest soils was richer in genera and species than that from cultivated soils.

2659. Murchie, W. R. **Biology of the Oligochaete *Eisenia rosea* (Savigny) in an upland forest soil of southern Michigan.** *Amer. Midl. Nat.* 60 (1), 1958 (113–31). 19 refs. B.A.P.

Presents observations on biology, seasonal activity and population densities, with particular reference to the influence of soil moisture. The studies were made in a forest containing Oak, Hickory, Elm, Ash, and Red Maple.

2660. Dobrovol'skij, G. V., and Titkova, N. F. Osobennosti struktury počv pojmennyh dubrav. **[Features of the soil structure in flood-plain Oak forests.]** *Počvoved.* 1960 (1), (15–25). 19 refs. [Russ.russ.e.] A.P.B.

Investigations in the middle and lower reaches of the Klyazma river valley [N. of Moscow] showed that the structure of (1) sod-forest, and (2) sod-meadow-forest soils was better developed than that of (3) meadows with rich herbaceous vegetation. The good structure of (1) and (2) was noticeable only in the $A_1$ horizon. Most of the structural soil aggregates in flood-plain Oak forests were earthworm casts, and occurred mainly in the $A_1$ horizon. There were fewer casts in (3), but they were distributed more evenly and to a greater depth.

2661. Mellanby, K. **The biological importance of the invertebrate soil fauna.** *Soils & Fertil.* 23 (1), 1960 (8–9). 8 refs.

Makes the point that the importance of invertebrates (particularly earthworms) may be overrated if only their sheer bulk is taken into consideration to the exclusion of their low metabolic rate. Moles, on the other hand, have a high metabolic rate, and 4 moles (total weight 1 lb.) may be considered to have the 'biological equivalent' of 1000 lb. of earthworms, which is above the normal population of 1 acre of pasture. Two moles (weighing 4 oz. each) can bring to the surface in 24 hours a greater weight of soil than can a whole population of earthworms with a total body weight of nearly half a ton. [Cf. *F.A.* 15 No. 2245.]

2662. Drift, J. van der. **Field studies on the surface fauna of forests.** *Meded. Inst. Toegep. Biol. Onderz. Nat.* No. 41, 1959. pp. [25]. 18 refs. [E.e.]

Data collected from baitless trapping in adjacent Oak woods (mull and mor) near Hoenderloo in 1950–52 and in a Scots Pine wood near Arnhem in 1951–55 are shown in histograms illustrating the periods of activity of different predatory species of carabids, other beetles and spiders. Periods of occurrence for a given species proved to differ only slightly from year to year and from place to place, but there were some marked differences between species. Beetles were grouped into species having summer larvae (greatest reproduction and highest captures in spring to early summer) or winter larvae (with these factors highest in summer to autumn). Comparison with literature suggests that in the species with winter larvae the reproductive period occurs increasingly later in the more northerly latitudes. Fluctuations in population density throughout the period were probably related to meteorological conditions, but the general pattern of distribution varied very little.

### 116. Hydrology. Water Conservation. Soil Conservation and Erosion

See also Nos. 2636–7, 2642, 2708, 2915, 3108–9, 3167.

2663. Wald und Wasser. Bericht über die Aussprachetagungen des Arbeitskreises 'Wald und Wasser' in Hilchenbach (1955) und in Zwiesel (1958). **[Forest and water. Report on the meeting of the 'Forest and Water' working group at Hilchenbach**

**(1955) and Zwiesel (1958).]** *Mitt. ArbKreis Wald u. Wasser, Koblenz* No. 3, 1959. pp. 75 + 22 plates. 19 refs. [G.]

Includes two papers on the disposal of untreated effluent from a sweet factory in Westphalia in a forest (*E. Mierig*; *F. K. Hartmann*) [describing the system of pipes and ditches used, the site and the stands, and preliminary results (generally favourable, particularly with Poplars) where quantities equivalent to a depth of 400 mm./ha./year were distributed over the year]; three papers on the hydrology of Schwarzer Regen river (Bavaria): its geomorphology (*C. Priehäusser*), its streamflow (*H. Kern*), and possible improvement of the water regime by forestry (*K. Klotz*) [largely by conversion of pure Spruce and Beech to mixed uneven-aged forest, plus planting of Silver Fir]; and one paper on the supply of water from rain and fog, and snow distribution in the Grosser Falkenstein (*A. Baumgartner*) [cf. *F.A.* 20 Nos. 1350–1].

2664. **Proceedings of the Third Formal Conference of Hydrologists of the East and Central African Territories on Hydrology and Water Resources held at Kampala, Uganda, 19th to 23rd August, 1958.** Government Printer, Nairobi. 1959. pp. vi + 99 + 29 photos & sketchmaps. Many refs. Price 30*s*.

Includes the following papers, with discussions: Problems in estimating yields and intensities from large catchments in Central Tanganyika (*R. G. MacWilliam*); Study of streamflow effects of land-use changes in catchment areas (*H. C. Pereira*) [see following abstract]; Hydrological instrumentation and measurements: proposed standardization of equipment and techniques as applied to the measurement of evaporation (*W. G. Wannell*); and Recent developments in hydrology (*H. W. Underhill*) [a review, with 142 references, mentioning, *inter alia*, the use of radar for the location of rain storms].

2665. PEREIRA, H. C. **Study of the streamflow effects of land-use changes in catchment areas.** In *Proceedings of the Third Formal Conference of Hydrologists of the East and Central African Territories on Hydrology and Water Resources*. Nairobi. 1959. pp. 5–11; 72–3. 9 refs.

Briefly surveys experimental work and methods of study in progress in E. Africa (with some notes on equipment) and recent American research, on land-use planning, river control, and water supply. Current investigations in E. Africa include: conversion of heavy rain forest to Tea, and Bamboo forest to conifers; the effect of native cultivation of steep hillsides in a formerly forested catchment area; and the effect of grazing control and pasture improvement on the flash-flood regime in semi-arid bush country. At 8700 ft. alt. and 44 in. rainfall, water was saved when Bamboo was cleared and conifers were planted; but at 15–20 years, Cypress consumed about as much water as the Bamboo, and Pine, at 30 years, consumed more. In the discussion the author, while stating that forests are the result, not the cause of rainfall, mentions a place on the Mufindi [Tanganyika] escarpment whose long-term records show the same amount of rain in a forested and an adjacent deforested area, but only half the number of rain days in the latter, mainly as a result of mist dispersal over a heated surface.

2666. PEREIRA, H. C. **Effects of conversion of Bamboo forest to softwood plantations.** *Progr. Rep. E. Afr. Catchment Area Res. E. Afr. Agric. For. Res. Organ.* No. 2, 1958. pp. 22 + 3 tbls., 1 map; No. 8, 1959. pp. 14 + 2 tbls. 6 refs.

Describes the design of a study of the hydrological and other effects of Bamboo on 3 catchments: (*A*) in which 85% of the area is cleared and planted with Pine; (*B*) to be left undisturbed; and (*C*) as (*B*) until its behaviour in disposal of rain storms has been determined and compared with that of (*B*), when it will be cleared and planted with softwoods; (*D*) and (*E*) comparable valleys at 8000–10,000 ft., (*D*) at present Bamboo forest and (*E*) having 10% of its area under well established softwood plantations.

2667. PEREIRA, H. C. **Effects of Tea plantation development in the Southwest Mau rain forest.** *Progr. Rep. E. Afr. Catchment Area Res. E. Afr. Agric. For. Res. Organ.* No. 3, 1958. pp. 16 + 3 tbls., 1 sketchmap.

Describes the lay-out of the experiments (two small catchments) and their vegetation, and gives data from preliminary hydrological measurements.

2668. PEREIRA, H. C. **Conversion of rain forest to Tea plantation.** *Progr. Rep. E. Afr. Catchment Area Res. E. Afr. Agric. For. Res. Organ.* No. 7, 1959. pp. 4.

After two complete years of hydrological measurements under forest cover, the whole area is being felled and planted to Tea.

2669. GRAY, K. M. **Watershed [catchment-area] management in the United States of America.** Forestry Commission of New South Wales, Sydney. 1958. pp. 73 + 1 map. 124 refs.

Account of a planned and comprehensive study tour, including references to problems of forest recreation, finance and policy, fire protection and management, and ending with specific recommendations for N.S.W. The 124 references are N. American and Australian.

2670. LULL, H. W. **Forested municipal watersheds in the northeast.** *J. For.* 58 (2), 1960 (83–6). 10 refs.

Discusses catchment-area management policy with particular reference to tree planting, and gives figures for areas under public and private control in 10 states.

2671. SINCLAIR, J. D., HAMILTON, E. L., and WAITE, M. N. **A guide to the San Dimas Experimental Forest.** *Misc. Pap. Calif. For. Range Exp. Sta.* No. 11 (rev.) 1958. pp. 8 + 1 photo, 1 map, 1 tbl.

Briefly indicates the design of studies on climate, stream-flow, erosion, run-off, rainfall reaching the ground under different types of vegetation, evapotranspiration (with some account of the lysimeter installations), and physical features. Studies of catchment management are also being made. [Cf. *F.A.* 13 No. 2743; 21 No. 1369.]

2672. VOIGT, G. K. **Distribution of rainfall under forest stands.** *For. Sci.* 6 (1), 1960 (2–10). 11 refs.

Rainfall distribution patterns were investigated under (*a*) *Pinus resinosa* (35 years old, 85% closed canopy), (*b*) *Tsuga canadensis* (in 70/30 mixture with hardwoods, 90% closed canopy when hardwoods were in leaf), and (*c*) *Fagus grandifolia* (uneven-aged, 100% closed canopy when in leaf). Soil moisture observations showed that a considerable portion of the water that fell on the canopy was concentrated by the foliage, branches, and stem, and eventually released to the soil in a relatively narrow band round the base of the tree. There were indications that the water flowing down the stem tended to follow the larger roots into the soil. When the magnitude of stemflow was calculated on the basis of the absorption area, it was found that the soil at the base of the average (*a*) tree received about ⅕ of the amount that fell in the open, soil under (*b*) received the same amount as in the open, and soil under (*c*) 2½ times as much. Water recovery values from stem segments of the 3 species indicated that bark texture may offer a partial explanation for the stemflow differences. Bark of (*a*) absorbed considerably more water than that of (*c*). Further observations on (*a*) indicated that much of the water concentrated by the foliage and branches fell in a diffuse zone round the stem rather than flowing down the outer bark surface. Presumably this was due to the curled bark plates that caused the water to drop rather than flow.

2673. MOLTSCHANOW [MOLČANOV], A. A. Die hydrologische Rolle des Kiefernwaldes auf Sandböden. **[The hydrological role of Pine forest on sandy soils.]** Deutscher Bauernverlag, Berlin. 1957. pp. 404. [G.] 78 illustrations. Price *DM*.43.60. From *review* in *Forstarchiv* 30 (12), 1959 (244).

The book (translated by H. Stillmark and E. Ehwald) is based on the author's and other research in European Russia, including investigations on the effect of stand age, stand density, and ground flora, on stand water consumption. [Cf. *F.A.* 20 No. 2716.]

2674. CURTIS, W. R. **Moisture storage by leaf litter.** *Tech. Note Lake St. For. Exp. Sta.* No. 577, 1960. pp. 2.

Samples of litter 2–3 in. deep of (*a*) hardwood and (*b*) Scots Pine were placed in the open in boxes with wire-netting bottoms over galvanized tanks. Their moisture storage capacity was calculated by subtracting the quantity that filtered through into the tanks from the total precipitation. This was measured after each of 136 storms during 3 growing seasons. The amount of moisture held by (*a*) was 34·2% of total precipitation vs. 33·2% for (*b*), though it varied with size of storm. For rains of $< 0·25$ in., 93·7% was retained by both litters, but for rains $> 1·00$ in. only ca. 11% was held. In terms of inches of water per annum, (*a*) held 8·7 in. and (*b*) 8·4 in. Since (*a*) weighed about 1½ times as much as (*b*), possibly (*b*) of equal weight would intercept more moisture.

2675. ČISTJAKOV, A. R. Kurtinnoe smešenie porod povyšaet vodoohrannuju rol′ nasaždenij. **[Mixture by groups improves water conservation by forest stands.]** *Lesn. Hoz.* 12 (2), 1959 (68). [Russ.]

Tabulated data on the depth of the snow layer and of soil freezing in groups of (*a*) Spruce, (*b*) Birch, (*c*) *Tilia* sp. and (*d*) in small clearings, indicate the beneficial effect of the broadleaved species promoting infiltration during the period of snow melting.

2676. MILLER, D. H. **Transmission of insolation through Pine forest canopy, as it affects the melting of snow.** *Mitt. Schweiz. Anst. Forstl. Versuchsw.* 35 (1), 1959 (57–79). 54 refs. [E.g.f.it.]

A critical review, embracing European as well as N. American literature, of the factors involved, discussing in turn the influence of canopy density, canopy depth, and 'stem density' (sum of all stem diameters—cf. *F.A.* 7 No. 716; 9 No. 2040), which last the author considers a better parameter of radiation transmission than either b.a. or canopy density; and concluding that only a small fraction of the insolation incident in even a thin stand escapes again to outer space. The implications of this for the climatology and hydrology of forested regions, notably those carrying winter snow, and for evapotranspiration, are considered and exemplified in some detail, and in the light of various problems raised, suggestions are offered for improving field research.

2677. BAY, R. R. **Soil freezing observations after changes in forest cover.** *Tech. Note Lake St. For. Exp. Sta.* No. 576, 1960. pp. 2.

Differences in soil freezing after conversion of an area of brush and Aspen to *Pinus resinosa* were observed early in 1957 and 1958 at the Pike Bay Experimental Forest, near Cass Lake, Minn. The 19-year-old plantation (*a*) had a b.a. of 94 sq. ft./acre vs. 54 sq. ft. for the adjacent undisturbed stand (*b*). Depth of freezing was measured periodically at various points in (*a*) and (*b*) with a penetrometer. In both years, concrete frost was deeper and remained longer in the spring in (*a*). A duff-mull type humus was found in (*b*) with a mean depth of 3·3 in. and some organic matter in the soil. The mor humus found in (*a*) had only 1·5 in. mean depth, with almost no organic matter in the soil. Early winter snow averaged 1·7 in. deeper in (*b*). In 1957, snow remained longer in (*a*); in a normal year the disadvantages of deeper and longer-lasting soil freezing in (*a*) were offset by delayed melting of snow. In 1958, however, the unusually small snowpack had disappeared by early March. Under these circumstances, delayed thawing of frozen soil in (*a*) would seriously affect infiltration of early spring rain.

2678. **Research on Black Mesa—a progress report.** *Sta. Pap. Rocky Mt. For. Range Exp. Sta.* No. 41, 1959. pp. 18 + 1 map.

Reports briefly on a co-operative project established in 1954 on Black Mesa, S.W. Colorado, to study grazing and catchment management, (3 catchments subjected to different intensities of grazing, and studies of relative water consumption by Aspen, Spruce, and grassland), and range rodents.

2679. GREEN, F. H. W. **Four years' experience in attempting to standardize measurements of potential evapo-transpiration in the British Isles and the ecological significance of the results.** *Publication, Association Internationale d'Hydrologie Scientifique, Gentbrugge* No. 48, 1959 (92–100). 1 ref. [E.e.f.]

Prolonged and widespread observations suggest that (1) potential evapo-transpiration (PE) from a grass sward is the most representative PE standard in N.W. Europe; (2) observed (i.e. not computed) PE allows computations of water deficits and surpluses even with doubtful precipitation data. [Cf. *F.A.* 18 No. 3665.] *From author's summary.*

2680. GORŠENIN, N. M. Vlijanie splošnyh rubok lesa na režim rečnogo stoka v gornyh uslovijah Karpat. **[The influence of clear fellings on stream flow in the Carpathians.]** *Vestn. sel'.-hoz. Nauki, Moskva* 4 (11), 1959 (90–7). [Russ.e.g.f.] O.W.

Tabulates streamflow rates and precipitation in the catchment for three small rivers, for each of the four seasons, for the periods 1947–51 and 1952–56. The volume of fellings in the catchments increased during the second period, and this appeared to have the result of making streamflow more irregular, though the total water yields differed little from those of the first 5-year period. Streamflow rates of the rivers Prut (1947–56) and Tissa (1948–55), together with the amounts of soil carried away by them, are tabulated and, in the light of these data, improved forestry practices on the catchments are considered necessary.

2681. TAKEDA, S., and MURAI, H. **[On the effects of surface cover on the infiltration capacity of forested areas.]** *J. Fac. Agric. Iwate Univ.* 4 (3), 1959 (243–52). 9 refs. [Jap.e.*e*.] O.R.E.

Infiltration and rainfall relationships were investigated on 15 sites with different geological structure, soil condition and vegetation cover, using two types of infiltrometer. Tabulated data and results are given in English.

2682. ORR, H. K. **Precipitation and streamflow in the Black Hills.** *Sta. Pap. Rocky Mt. For. Range Exp. Sta.* No. 44, 1959. pp. 25. 7 refs.

Statistical analysis showed a definite trend towards less run-off per unit of precipitation in the Rapid Creek drainage—the only stream with a long enough record for such an analysis—between 1915 and 1942, when its gauging station was closed. Several reasons for the trend are suggested, including the gradual transformation of virgin *Pinus ponderosa*, considered the dominant plant species in this area, to denser second-growth stands drawing more heavily on moisture.

2683. **Watershed management research. Planted Pinesin North Mississippi.** *Extr.* from *Rep. Sth. For. Exp. Sta. 1958*, 1959 (9–10).

A year's run-off from 20-year-old Loblolly plantations on formerly eroding sites was 2·4% against 9·9 from depleted hardwood areas and 14·5 from old fields. Within each cover type, run-off was greatest on loess soils. Moisture available to Loblolly seedlings planted on shallow loess was greatest where all hardwoods had been removed; survival (94%) and height (8·75 ft.) after 3 years were significantly greater than where over- or under-storey hardwoods only had been removed. Wax emulsions sprayed over Loblolly seedlings to reduce transpiration increased their mortality.

2684. GUCCI, E. Osservazioni sulla conservazione del bosco e sulle possibilità di nuovi rimboschimenti nel Lagonegrese. **[The preservation of existing woodland and the possibilities of new afforestation in the Lagonegrese, [S. Lucania].]** *Monti e Boschi* 11 (2), 1960 (66–71). 7 refs. [It.f.e.]

Describes the erosion, floods, etc., consequent on the destruction of the forests, and makes suggestions for remedial measures.

2685. SOLJANIK, I. Solarizacija kao faktor za formiranje biljnog pokrivača uopšte i uslova za eroziju. **[Insolation as a factor in the formation of vegetation cover in general, and conditions favourable to erosion.]** *Šumarstvo* 12 (7/8), 1959 (342–51). 21 refs. [Serb.f.*f*.]

Discusses the effect of insolation on the formation of natural plant cover, especially in the context of slopes in Jugoslavia, and investigations on methods of establishing vegetation on slopes eroded or threatened by erosion. These methods, e.g. making gradoni, terracing, etc., can reduce the harmful influence of insolation on S. slopes, and increase its beneficial influence on N. slopes.

2686. GORŠENIN, N. M. Ėrozija počv v gornolesnoj zone Karpat. **[Soil erosion in the montane forest zone of the Carpathians.]** *Počvoved.* 1959 (11), (26–36). 4 refs. [Russ.russ.e.] A.P.B.

Investigations were made on erosion of brown forest soils (mostly formerly under Spruce) of two types: (1) with many large stones, and (2) light clay-loams with small stones. Gully and sheet erosion took place on (2) after clear fellings. On (1), sub-surface erosion of humus and fine soil predominated, and here both clear and shelterwood felling should be forbidden. Ground skidding should never be done when there is no snow cover.

2687. AUBRÉVILLE, A. Érosion sous forêt et érosion en pays déforesté dans la zone tropicale humide. **[Erosion under forest cover and erosion in deforested country in the humid tropical zone.]** *Bois For. Trop.* No. 68, 1959 (3–14). [F.e.span.]

Gives examples (illustrated by photographs) of erosion (e.g. slips, gullying) occurring under cover of dense moist tropical forest in Madagascar, the Congo and Brazil.

2688. Downes, R. G. **The ecology and prevention of soil erosion.** *Repr.* from *Monographiae Biologicae* 8, 1959 (472–86). 20 refs.

Briefly examines the various manifestations of wrong land-use and outlines the effects on ecological equilibrium of the loss of original vegetation cover (including dry sclerophyll forest of *Eucalyptus* spp.).

2689. Baldwin, H. I. **Seeding logging roads [to grass] to control erosion.** *Fox For. Note* No. 76, 1959. pp. 1. 1 ref.

Grass seed, lime and fertilizer were applied in May 1959 to 11 sample 100-ft. sections of bulldozed roads in the Fox Forest, New Hampshire, after initial ditching, water-bar [grip] preparation, and surface raking. Details are given on costs of labour and materials and it is concluded that: (1) for best results, sand or gravel surfaces should be coated with loam before sowing; (2) sowing is best done immediately after bulldozing, before the road is used; (3) turf cover prevents frost heaving as well as erosion; (4) although well developed turf is cut up under heavy traffic in summer, little or no damage occurs when the ground is frozen or snow-covered, i.e. when the heaviest loads are hauled.

2690. Haupt, H. F. **A method for controlling sediment from logging roads.** *Misc. Publ. Intermt. For. Range Exp. Sta.* No. 22, 1959. pp. 22. 1 ref.

Describes a method of protecting intervening slopes, other downhill roads, and stream channels from the damaging effects of sediment originating from roads higher on the slope. The method is based on a study already reported [cf. *F.A.* 20 No. 4108] wherein a multiple regression equation was developed relating sediment flow distance to 4 significant road and slope characteristics, of which slope-obstruction index and cross-ditch interval are the most directly controllable and allow flexibility of treatment. The equation can, e.g., predetermine the distance or width of a protective strip needed to dissipate sediment movement that may occur from a road to be built. Its application in road construction and prevention of catchment damage, including the treatment of abandoned roads, is explained in detail with examples and tables.

2691. García Nájera, J. M. Informe al gobierno de la República Argentina. El problema torrencial. (Organización del Servicio de corrección de torrentes. Investigaciones y experiencias.) **[Report to the Argentine government. The problem of torrent control. (Organization of the torrent-training service. Research and experiments).]** Expanded Technical Assistance Program, FAO, Rome. *FAO Report* No. 1142, 1959. pp. ii + 63 + 8 maps. [Span.]

Reviews the hydrological problems of Argentina, outlines projects for the creation of a hydrological-cum-forestry service, and discusses the lines on which work (including afforestation programmes) should proceed.

2692. Ahmad, S.-u.-D. **Distribution, ecology, economics, physiology and propagation of Khar plant (*Haloxylon recurvum* Bunge).** *Pakistan J. For.* 9 (4), 1959 (267–72). 9 refs.

It is proposed to sow this halophyte extensively for desert reclamation, harvesting it as a crop for camel fodder or for the manufacture of washing soda ($Na_2CO_3$).

## 14. Systematic Zoology

### 145.7. Insecta. Entomology

See also Nos. 3406 *et seq.*, 3800 *et seq.*

2693. Ross, D. A. **The Maple leaf cutter, *Paraclemensia acerifoliella* (Fitch) (Lepidoptera: Incurvariidae), descriptions of stages.** *Canad. Ent.* 90 (9), 1958 (541–55). 21 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 464.) O.R.S.

Describes taxonomically important features at all stages of its life history.

2694. Agenjo, R. Dos nuevas subspecies españolas de *Lymantria monacha* (L., 1758) (Lep. Lymant.). **[Two new subspecies of *L. monacha* in Spain.]** *Bol. Serv. Plagas For., Madrid* 2 (4), 1959 (107–14 + 1 plate). [Span.]

Presents descriptions of *L. monacha* subsp. *neirai* found in Santander province, and *L. monacha* subsp. *ceballosi* found near Madrid.

2695. Harris, E. C. **A note on the secondary sex characters of the death-watch beetle, *Xestobium rufovillosum* (Col. Anobiidae).** *Ent. mon. Mag.* 237 (1140), 1959 (208–9). 4 refs.

Describes and illustrates a series of secondary sex characters based on the last visible abdominal sternite.

2696. Lyon, R. L. **A useful secondary sex character in *Dendroctonus* bark beetles.** *Canad. Ent.* 90 (10), 1958 (582–4). 2 refs. O.R.S.

The seventh abdominal tergite of the ♀ differs from that of the ♂ in having a gently curved instead of angular rear margin. The distinct dark band of pigmentation also is lacking, although the tergite often shows a gradient of increasing pigmentation rearwards.

2697. Johnson, N. E. **Field identification of ambrosia beetles attacking coniferous timber in the Douglas-Fir region.** *Canad. Ent.* 90 (4), 1958 (236–40). 4 refs. O.R.S.

Presents information based on the general morphology of the insect, diameter of bore holes, and the shape of wood borings, for the ready identification of *Platypus wilsoni*, *Trypodendron lineatum*, *Gnathotrichus sulcatus*, *G. retusus* and *Xyleborus saxeseni*, all known to cause damage to logs in the forest.

2698. Browne, F. G. **Notes on two Malayan scolytid bark-beetles.** *Malay. Forester* 22 (4), 1959 (292–300 + 2 plates).

*Poecilips subcribrosus* (Blandf.) comb. nov. (= *Xyleborus infans* Hag., syn. nov.), and *Ozopemon brownei* Sch.

2699. Lindquist, O. H. **A key to the larvae of leaf-mining sawflies on Birch in Ontario with notes on their biology.** *Repr.* from *Canad. Ent.* 91 (10), 1959 (625–7). 6 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 509.)

Deals with *Fenusa pusilla*, *Profenusa alumna* and *Heterarthrus nemoratus*.

## 15. Animal Ecology. Game and Fish Management, Hunting, Shooting and Fishing

See also Nos. 3383–3405, 3457.

2700. Schwenke, W. Über die biozönotischen Grundlagen der Forstzoologie. **[The biocoenotic bases of forest zoology.]** *Forstwiss. Cbl.* 79 (1/2), 1960 (1–17). 48 refs. [G.]

These, and the knowledge gained by using them (e.g. in research on forest zoological inventories, outbreaks, succession, etc.), are discussed.

2701. McDonald, W. A. **Nocturnal detection of tsetse flies in Nigeria with ultra-violet light.** *Nature, Lond.* 185 (4716), 1960 (867–8). 4 refs.

Describes a successful technique for observing the nocturnal habits of the fly. Flies marked with fluorescent paint are released and can then be detected by ultra-violet light, without being disturbed. Many trials with the riverine species *Glossina palpalis* showed that about half the flies rest during the night within 12 in. of the ground, on leaves or small twigs, but never on tree trunks or branches. Some 50 recoveries of marked specimens of the open woodland species, *G. submorsitans*, in a forest-island breeding site, revealed the flies resting on twigs, leaves, and small creepers at heights of 1–15 ft., with the majority above 7 ft. It would appear that this species' daytime resting preference for tree trunks should be considered when planning control by residual insecticides.

2702. Fitter, R. S. R. **Birds and forests.** *Nature, Lond.* 185 (4715), 1960 (731–2).

Summarizes papers and discussions at a joint conference of the British Trust for Ornithology and the Forestry Commission held 30 Oct.–1 Nov. 1959 at Lyndhurst, dealing with birds as forest pests and predators on forest pests, and with forests as habitats for birds.

2703. White, J. E., and Pearson, P. G. **Small mammal populations in relation to control burning in the Pine barrens of New Jersey.** *Abstr.* in *Bull. Ecol. Soc. Amer.* 40 (3), 1959 (79). A.P.B.

Study of the effect of burning ground cover in the summer of 1957 indicated no significant difference in numbers of small mammals between unburned plots, plots burned ½ year before study, and plots burned 2½ years before study. During the winter of 1958, a 2½-year plot and half of an unburned plot were control-burned. Trapping in summer 1958 indicated an over-all decrease in the small mammal populations of the study plots except in plots where burning had occurred. Thus, a relative increase of population was associated with prescribed burning. Vegetation, soil, population turnover, movement, additional burning studies, and other aspects of the problem are currently being studied.

2704. Fooks, H. A. **The roe deer.** *Leafl. For. Comm. Lond.* No. 45, 1960. pp. 16.

Describes the habits of the animal and the best methods of controlling its numbers.

2705. Trumbo, H. A., and Chappell, W. E. **Techniques involved in the use of chemicals for establishing wildlife clearings.** *Proc. 13th Ntheast. Weed Control Conf.* 1959 (337–41). From *abstr.* in *Weed Abstr.* 8 (10), 1959 (1890). O.W.

Preliminary results of trials on trees up to 18 in. diam. with fenuron 1–10 g./stem, monuron 5–10 g./stem, both in granular form, and with $NH_4$ sulphamate 7 lb./2 gal. water and 2,4,5-T 12 lb./100 gal. fuel oil, both applied in frills, indicated that fenuron and monuron would be the most successful in establishing wildlife clearings; fenuron was the quicker acting. Predominant species in the trial areas were Red Oak, White Oak, Chestnut Oak, Red Maple, Sourwood, Table Mountain Pine, and Black Gum. In another trial with fenuron at 1,2 and 4 g./clump on mainly the same species, of low growth and 5 years old, all species except *Pinus pungens* (which had turned brown) were defoliated and appeared dead 2–3 months later, but *Pyrularia pubera* showed a tendency to re-bud after only 1 g./clump.

2706. Biswell, H. H. **Prescribed burning and other methods of deer range improvement in Ponderosa Pine in California.** *Proc. Soc. Amer. For. 1959*, 1960 (102–5). 23 refs.

Discusses 5 methods of improving deer range in Ponderosa Pine: prescribed burning, thinning of dense tree stands, planting of browse species, fertilizing browse species, and planting fruit trees.

2707. Lapointe, D. F. **Mourning dove production in a central Nebraska shelterbelt.** *J. Wildlife Mgmt.* 22 (4), 1958 (439–40). 5 refs. B.A.P.

Presents the results of a study made between 7 April and 15 Sept. in 1957. American Elm and Ponderosa Pine were preferred as nesting sites. A total of 26% of nesting attempts was successful, with production at ca. 34 doves/acre. *From author's summary.*

2708. Evans, W. A. **The effect of current West Coast logging practices upon fisheries resources.** *Proc. Soc. Amer. For. 1959*, 1960 (106–8).

Blames faulty logging methods and poor road construction and location standards for the considerable damage done to fishing in forest areas. Major causes of damage are: erosion, and hence silting-up of gravel beds, smothering of eggs already present, and destruction of insect food; an altered run-off pattern, with winter floods and reduced summer flows, resulting in unfavourably high water temperatures; slash in streams, creating an O deficiency during summer months when it decomposes; the accumulation of debris into jams, blocking upstream fish migration. Application of existing knowledge could eliminate ca. 80% of this damage.

## 16. General Botany

### 160. Plant Chemistry

See also Nos. 2624, 2640–1, 2654, 2732–3, 2759, 2843, 2847, 2874, 2956, 3267–71, 3319, 3694 *et seq.*, 3860 *et seq.*

2709. **A phytochemical register of Australian plants. Vol. I. Australian literature sources to 1954**

**together with a list of Australian genera.** [Commonwealth Scientific and Industrial Research Organization, Melbourne.] 1959. pp. 294.

Comprises: the register, with families arranged alphabetically and genera alphabetically under them, and against each species the constituents recorded for it, with the relevant references to the literature; a list of Australian (and naturalized) genera of flowering plants and ferns, showing the family of each; a list of Australian periodicals searched; and an index to the types of compounds listed in the register.

2710. ANDREWS, P., HOUGH, L., and STACEY, B. **Polysaccharide composition of leaves.** *Nature, Lond.* 185 (4707), 1960 (166–7). 4 refs.

A study was made for a number of species, including several trees. Arabinose and xylose formed a large part of the leaf polysaccharides of *Quercus robur* and *Ilex aquifolium*; xylan was a major component of *Fagus sylvatica* leaves; and araban was predominant in *Thuja orientalis*.

2711. SHASHA, B., and LEIBOWITZ, J. **Oleuropeic acid: a new compound from *Olea europaea*.** *Nature, Lond.* 184 (4704), 1959 (2019–20). 1 ref.

2712. FISCHER, F. G., and SEILER, N. Die Triterpenalkohole der Birkenblätter. **[Triterpene alcohols of leaves of *Betula verrucosa*.]** *Justus Liebigs Annalen der Chemie, Weinheim/Bergstr.* 626 (1/3), 1959 (185–205). 34 refs. [G.g.] O.R.S.

Two new triterpene alcohols—$C_{30}H_{52}O_3$, and $C_{30}H_{52}O_4$—were isolated. Their structures were studied. *From authors' summary.*

2713. PLOUVIER, V. Sur la recherche des acides quinique et shikimique chez quelques Anacardiacées. **[Quinic and shikimic acids in some Anacardiaceae.]** *C.R. Acad. Sci., Paris* 250 (9), 1960 (1721–3). 3 refs. [F.f.] O.R.S.

Species examined were *Mangifera indica*, *Anacardium occidentale*, *Pistacia* spp., *Schinus* spp., *Lithraea aroeirinha*, *Cotinus coggygria*, *Rhus* spp. and *Semecarpus anacardium*.

2714. CRONENBERGER, L. Identification du kaempférol dans les feuilles de quelques *Prunus*. **[Identification of kaempferol in the leaves of some *Prunus* spp.]** *C.R. Acad. Sci., Paris* 249 (25), 1959 (2866–7). 1 ref. [F.f.] O.R.S.

*P. avium*, *P. armeniaca*, *P. cerasus*, *P. domestica*, *P. mahaleb*, *P. persica*, and *P. spinosa*.

2715. CRONENBERGER, L. Sur l'isolement du rutoside à partir des feuilles de merisier (*Prunus avium*), et la présence de cet héteroside flavonique dans les feuilles d'abricotier (*P. armeniaca*), de prunier (*P. domestica*) et de prunellier (*P. spinosa*). **[The isolation of rutoside from leaves of *P. avium* and the presence of this flavonic heteroside in leaves of *P. armeniaca*, *P. domestica* and *P. spinosa*.]** *C.R. Acad. Sci., Paris* 249 (22), 1959 (2423–4). 2 refs. [F.f.] O.R.S.

2716. WALL, M. E., *et al.* **Steroidal sapogenins LV. Survey of plants for steroidal sapogenins and other constituents.** *J. Amer. Pharm. Ass. (sci. Ed.)* 48 (12), 1959 (695–722). 7 refs. O.R.S.

[Cf. *F.A.* 19 No. 1344.] Tabulated data are given for 921 species (mainly from the U.S.A.), representing 547 genera. Trees include species of *Acer*, *Betula*, *Carpinus*, *Aleurites*, *Castanea*, *Fagus*, *Quercus*, *Aesculus*, *Carya*, *Juglans*, *Acacia*, *Albizzia*, *Liriodendron*, *Eucalyptus*, *Fraxinus*, *Chamaecyparis*, *Picea*, *Pinus*, *Taxodium*, *Thuja*, *Tsuga*, *Tilia*, *Celtis* and *Ulmus*. Few steroidal sapogenins were found, but alkaloids were found in 86 species, including some trees.

2717. NICKELL, L. G. **Antimicrobial activity of vascular plants.** *Econ. Bot.* 13 (4), 1959 (281–318). 174 refs.

Lists alphabetically all the plants (ca. 1300) known to exhibit antimicrobial activity, indicating for each the family (157 in all), type of activity, type of extract tested, part(s) of plant tested, and the literature references. Flowering plants and conifers predominate, tree species being numerous. A second table lists the plants that showed no antimicrobial activity by the tests employed.

### 161. Physiology

See also Nos. 2624, 2755–6, 2781, 2783, 2830 *et seq.*, 3069–72, 3261, 3269, 3306, 3318–9, 3352, 3485, 3572, 3663.

2718. KRAMER, P. J., and KOZLOWSKI, T. T. **Physiology of trees.** McGraw-Hill Book Company, Inc., New York, Toronto, London. 1960. pp. xiii + 642. Many refs. Price 97*s*.

Covers, in 16 chapters, structure and functions, emphasizing ecological aspects and the interaction of trees in a stand, with full documentation. References to general works are given at the end of each chapter, the others in a bibliography of 67 pages, comprising mostly literature in English or German.

2719. HOLSTENER-JØRGENSEN, H. **A method for sand culture experiments.** *Forstl. Forsøgsv. Danm.* 26 (2), 1960 (339–44). [E.]

The apparatus (illustrated) comprises a polyethylene bucket, filled with sand and with a drainage layer at the bottom, connected by a rubber tube through a hole in the bottom to an aspirator bottle filled with a nutrient solution; this can be raised to the level of the bucket or above to saturate the sand with the solution, or lowered to allow the surplus to drain off.

2720. HOLZER, K., and LIEBESWAR, K. Eine einfache Kulturkammer für Sämlingsprüfung mit Nährlösungskultur. **[A simple culture chamber for seedling tests on nutrient solution.]** *Silvae Genet.* 9 (1), 1960 (17–20). 10 refs. [G.g.e.f.]

Describes a culture chamber specially devised for tests of forest tree seedlings. These are cultivated at nearly constant temperature with nutrient solutions in pure quartz sand, and are irradiated with artificial light (ca. 10,000 luxes). The nutrient solution is pumped once a day into the chamber and then sucked off again, thereby renewing the air in the substrate. The nutrient solution is also renewed about once a month according to the number of seedlings. The chamber allows for ca. 3–4 test series a year. Division of the culture chamber into 4 compartments allows for the study of the development of progenies to be tested simultaneously under different light regimes, all other conditions being equal. The size of the chamber allows simultaneous testing of 8000 seedlings (e.g. of Spruce). *From authors' summary.*

2721. ŠEMAHANOVA, N. M. Izučenie mikotrofii drevesnyh porod metodom čistyh kul′tur. **[Investigation of mycotrophy in woody species by the pure-culture method.]** *Izv. Akad. Nauk SSSR (Ser. biol.)* 1959 (5), (674–86). 33 refs. [Russ.russ.e.] A.P.B.

Describes the chambers developed by Melin, Hatch, Doak [cf. *F.A.* 18 No. 2596] and the author for studies of mycorrhiza on individual seedlings in sterile culture, and reviews world literature on such chambers, nutrient media, substrates, and seed disinfection, making recommendations on methods and material. Melin's chamber is considered to be more suitable for conifers and slow-growing species, and the author's (in which the aerial part of the plant is exposed) for broadleaved plants of vigorous growth.

2722. LYBECK, B. R. **Winter freezing in relation to the rise of sap in tall trees.** *Plant Physiol.* 34 (4), 1959 (482–6). 34 refs. O.R.E.

Preliminary experiments showed that when water was frozen in fine glass capillary tubes, bubbles of gas always became separated from the water. Gas bubbles were also formed in many tracheids of green *Picea abies* when wood was frozen and then thawed under kerosene. Twigs and stems of several species (Spruce, Birch, Maple) were investigated at temperatures below freezing. It was concluded that the sap was not supercooled but frozen. The amount of unfrozen water in the xylem of Spruce, Birch and Maple was measured calorimetrically and amounted to 30–40% of the dry weight. The % decreased with decreasing temperature but independently of the total water content. This indicates that the unfrozen water was bound to the wood, leaving all the sap within tracheids and vessels frozen. Freezing releases dissolved gas as bubbles in the conducting elements of the stem, and it is assumed that some mechanism exists capable of overcoming or mending the breaks formed by the bubbles, but nothing is known about its nature. *From author's summary.*

2723. KOZLOWSKI, T. T., and PETERSEN, A. E. **Variations in moisture contents of dormant buds.** *For. Sci.* 6 (1), 1960 (61–6). 10 refs.

Preliminary studies on dormant buds of *Ulmus americana*, *Aesculus hippocastanum* and *Pinus strobus* trees in full leaf indicated that moisture contents of dormant buds varied considerably during the day. Diurnal variations in m.c. are attributed to bud transpiration, internal redistribution of moisture within the tree, and absorption of moisture from the atmosphere.

2724. GLIGIĆ, V. Zimska transpiracija smrče na Igmanu. **[The transpiration of Spruce in winter on Mt. Igman [near Sarajevo].]** *Rad. Poljoprivred.-Šum. Fak., Sarajevo (Šum.)* 2 (2), 1957 (14–6). 5 refs. [Croat.g.]

Comparison of the transpiration rate of several species in the Karst region with rates measured in Leningrad in the 1920's showed fairly good agreement except for *Picea abies*, which transpired much less in the Karst. It is concluded that the peculiar conditions of the Karst have caused an extremely xerophilous ecotype of Spruce to develop there.

2725. MARCU, G. Cercetări comparative asupra transpirației la cîteva specii de *Quercus*. **[Comparative studies on the transpiration of some species of *Quercus*.]** *Rev. Pădurilor* 74 (12), 1959 (693–7); 75 (1), 1960 (20–2). 13 refs. [Rum.rum.russ.g.f.e.]

Measurements were made of water loss in young shoots by the rapid weighing method. In conditions of adequate soil moisture, the species tested were in the following order of increasing transpiration: *Q. frainetto*, *Q. pubescens*, *Q. pedunculiflora*, *Q. cerris*. Resistance to low atmospheric humidity was in the decreasing order: *Q. pubescens*, *Q. pedunculiflora*, *Q. cerris*, *Q. frainetto*.

2726. VIKTOROV, D. P., and BYSTRJANCEV, P. I. Vlijanie uslovij fosfornogo pitanija na transpiraciju sejancev drevesnyh porod. **[The influence of P nutrition on the transpiration of seedlings of woody species.]** *Dokl. Akad. Nauk SSSR* 128 (6), 1959 (1302–4). 11 refs. [Russ.] A.P.B.

Experiments were made with seedlings of *Acer negundo* and *Pinus sylvestris* grown in sand culture, and seedlings of the Pine in nursery beds, to determine the effect on transpiration of various dosages of P fertilizer. In both species, and under both conditions, the rate of transpiration decreased with increasing doses of P, e.g. in the nursery bed, the transpiration of Pine seedlings given 16 and 24 kg. $P_2O_5$/ha. was only 83·3 and 49·9% of that of untreated controls on Oct. 20, and 90·3 and 77·6% of it a month later, when all the transpiration rates were considerably lower. The possibility of using P to reduce transpiration losses in droughty areas is mentioned.

2727. HLEBNIKOVA, N. A. Transpiracija i fotosintez drevesnyh i kustarnikovyh rastenij v uslovijah Prikaspijskoj nizmennosti. **[Transpiration and photosynthesis of trees and shrubs in the Cis-Caspian lowland.]** *Trud. Inst. Les.* No. 38, 1958 (140–60). 26 refs. [Russ.]

Investigations were made from 1951 to 1954 on *Ulmus pumila* var. *arborea*, *Fraxinus pennsylvanica*, *Acer negundo* and *Elaeagnus angustifolia*, planted in strips in 1951 on solonetz and light-chestnut soils, and on the dark soils of the depressions. The transpiration rate fell sharply with decreasing soil moisture during the growing season, and was always higher for leaves directly exposed to sunlight than for shaded ones, with the exception of *A. negundo* from July onwards. The amount transpired per tree decreased during the growing season, and 66% of it was from leaves directly illuminated. In the latter, photosynthesis reached a maximum in the forenoon, and thereafter was depressed, often for the rest of the day. No direct relation between respiration and temperature was observed. The rate of photosynthesis decreased as the summer progressed, and was closely related to soil conditions, particularly soil moisture. Directly illuminated leaves did most of their respiration early in the summer, but later on (i.e. in the drier period) the shaded and partly shaded leaves assumed this role.

2728. RÜSCH, J. Das Verhältnis von Transpiration und Assimilation als physiologische Kenngrösse, untersucht an Pappelklonen. **[An investigation with Poplar clones on the use of the relationship of transpiration and assimilation as a physiological index.]** *Züchter* 29 (8), 1959 (348–54). 41 refs. [G.g.] E.M.B.

Measurements on cuttings of *P.* × *marilandica*, *P.* × *vernirubens*, *P.* × *serotina* and *P.* 'Flachslanden' showed, that, although the 4 clones formed a very uniform material, *P.* × *marilandica* showed a rather lower value for the transpiration/assimilation ratio than the others. The effect of varying light intensities and temperatures on the relationship between transpiration and assimilation is discussed and shown in graphs.

2729. PISEK, A., and KNAPP, H. Zur Kenntnis der Respirationsintensität von Blättern verschiedener Blütenpflanzen. **[Rate of respiration in leaves of various flowering plants.]** *Ber. Dtsch. Bot. Ges.* 72 (7), 1959 (287–94). 16 refs. [G.] O.B.D.

Tabulated results are presented of measurements (chiefly by cut-shoot techniques) made on 28 species, including some important trees. Some measurements (May–Aug. or Sept.) were made on all species at a constant 20° C., and winter (Nov.–Mar.) measurements on evergreens at both 0 and 20°. The means of monthly values are presented for dry weight of leaves in winter and for both dry and fresh weights of leaves in summer. In the evergreens, *Rhododendron ferrugineum*, *Pinus cembra*, *P. mugo* and *Picea abies*, both the current and the previous season's leaves, and in *P. abies*, both sun and shade leaves were sampled.

2730. VIRO, P. J. **Estimation of the effect of fertilization from needle colour.** *Oikos* 10 (2), 1959 (183–9). 7 refs. [E.]

The chlorophyll contents of Pine needles were determined (methods described) from trial plots of 5- and 15-year saplings, which had been treated with 10 single-element or combined fertilizers. It was concluded that chlorophyll content expresses neither the quantity of nutrients in the soil, nor vigour of growth. Thus it cannot be used to estimate the effect of fertilizers, nor the tone of green colouring, which may be due to other factors, to indicate vigour of growth. A similar experiment might prove better suited to conditions of extreme nutritional deficiency, where the amount of a certain nutrient is so small that chlorosis is induced. The sites under study were of medium fertility. Some elements appear to increase, other to decrease, chlorophyll content in needles. The fact that some decrease it, yet do not adversely affect growth, might mean that these elements stimulate photosynthesis, so that a smaller chlorophyll content maintains the same growth as a greater content in less favourable nutritional conditions.

2731. DADYKIN, V. P., BEDENKO, V. P., and DAVYDOVA, JU. A. O zavisimosti optičeskih svojstv list'ev rastenij ot udobrenija počvy. **[The relationship between the optical properties of plant leaves and soil fertilizing.]** *Dokl. Akad. Nauk SSSR* 128 (6), 1959 (1305–8). 13 refs. [Russ.] A.P.B.

[Cf. *F.A.* 21 No. 97.] Measurements were made of the transmission and reflection of radiant solar energy by leaves of: 8-year-old *Fraxinus pennsylvanica* and *Quercus robur* grown without fertilizers, or with NK or NPK; 2-year-old *Pyrus malus* and *Corylus avellana* given NPK, $NP_3K$ or, in the case of *P. malus*, no fertilizer. The spectral transmission and reflection curves are shown and discussed. Greatest reflection and transmission, i.e. least absorption, were found in the leaves of unfertilized controls. Increased doses of P reduced both reflection and transmission.

2732. DAVID, R., *et al.* Évolution de l'amidon et des composés soudanophiles dans les pseudophylles de *Pinus caribaea* Mor. et de *Pinus pinaster* Sol. **[Formation of starch and fatty compounds in the pseudophylls of *P. caribaea* and *P. pinaster*.]** *C.R. Acad. Sci., Paris* 249 (25), 1959 (2820–2). [F.f.] O.R.S.

Starch appears earlier in the spring and disappears earlier in late summer in the needles of *P. caribaea* than in those of *P. pinaster*. Lipides accumulate in the needles of both species during the autumn, in larger quantity in those of *P. caribaea*, which contain less starch. *From authors' summary.*

2733. MEYER-MEVIUS, U. Vorkommen und Transport von Kohlenhydraten und Stickstoffverbindungen in den pflanzlichen Leitungsbahnen. **[Occurrence and movement of carbohydrates and N compounds in plant conduction channels.]** *Flora, Jena* 147 (4), 1959 (553–94). 166 refs. [G.g.] O.B.D.

Studies were made of (1) the sieve-tube sap, and (2) the rising sap, in a variety of species, including studies of the flow and chemical composition of sap of *Carpinus betulus*, *Betula pubescens*, *B. verrucosa*, *B. nigra* and also *Vitis vinifera*. In these species, (2) consisted mainly of glucose and fructose. In isolated instances, sucrose and traces of galactose were also found. Besides numerous amino acids, considerable quantities of citrullin were also present.

2734. HELLMERS, H., and BONNER, J. **Photosynthetic limits of forest tree yields.** *Proc. Soc. Amer. For. 1959*, 1960 (32–5). 12 refs.

Analysis of available data indicates that the photosynthetic efficiency (in % of incident solar energy captured) of closed stands of *Fagus sylvatica* is 2·5% for the 5·5 months during which it has green leaves, and for closed stands of *Pinus sylvestris* 2·2% over the whole year. This compares with 2 ± 0·5 for annual crop plants. The evidence suggests that the maximum productivity of forests stands is determined by the 2% efficiency with which light energy is used in photosynthesis by a plant stand. The upper limit of forest tree yield appears to be identical with the upper limit of yield of annual crops.

2735. COOMBE, D. E. **An analysis of the growth of *Trema guineensis*.** *J. Ecol.* 48 (1), 1960 (219–30). 30 refs.

In a glass-house at Cambridge, under conditions of temperature, humidity, shading, insolation, and day length comparable with those in a clearing in W. African rain forest, young plants of *T. guineensis* grew at estimated mean unit leaf-rate (or net assimilation rate, i.e. rate of increase in dry weight of the whole plant per unit leaf-area) of 14–15 g./sq. m./week, vs. 33·34 g. for *Helianthus annuus*. The rapid growth of *T. guineensis* cannot be explained by a high rate of dry-weight increase per unit leaf-area, but may lie in its prolonged and efficient development of new leaf-area. A review of the literature suggests that many woody plants, both temperate and tropical, show lower unit leaf-rates than herbs under similar conditions. *From author's summary.*

2736. FROMANTIN, J. Les réactions des cotylédons de *Cryptomeria japonica* aux substances de croissance. Peuvent elles contribuer à éclaircir ses parentés phylétiques? **[The reactions of *C. japonica* cotyledons to growth-regulating substances. Can they throw light on its phyletic affiliations?]** *Trav. Lab. For. Toulouse* 1 (6), Art. 1, 1958. pp. 4. 3 refs. [F.]

Cotyledons of *C. japonica* showed an increase of 10·4–68·4% in cotyledon length for increasing strengths of 2,4,5-T (0·014–144 mg./litre), whereas 3 *Pinus* spp. all showed a reduction in length.

2737. FROMANTIN, J. Réactions comparées des cotylédons de quelques Cupressacées et Abiétacées (du genre *Pinus*) à l'action de l'acide 2,4,5-trichlorophénoxyacétique et de l'acide indol-$\beta$-acétique. **[Comparative reactions of the cotyledons of some Cupressaceae and Abietaceae (of the genus *Pinus*) to the action of 2,4,5-T and $\beta$ IAA.]** *Trav. Lab. For. Toulouse* 1 (6), Art. 2, 1958. pp. 9. 3 refs. [F.]

In general, the Cupressaceae tested (*Thuja orientalis*, *Cupressus macrocarpa*, *C. sempervirens*, *Tetraclinis articulata* and *Chamaecyparis lawsoniana*) showed positive reactions (increased length) while the Abietaceae (*Pinus pinea*, *P. sylvestris* and *P. peuce*) showed negative reactions (reduced length).

2738. ALLARY, S. Évolution annuelle des substances inhibitrices acides des bourgeons de *Quercus pedunculata* Ehrh. **[Seasonal production of acid growth inhibitors in buds of *Q. robur*.]** *C.R. Acad. Sci., Paris* 250 (5), 1960 (911–3). 5 refs. [F.f.] O.R.S.

[Cf. *F.A.* 21 No. 1436.] Studies on branches collected in a nursery from the same population of Oaks showed various stages in the growth period: (1) During the weeks before flushing, the acid extract is still rich in inhibitors. (2) As the buds begin to grow (increase in length of 1 mm.) the inhibitors decrease and then disappear completely; this stage is very brief, and as soon as the buds show any green, the inhibitors reappear and reach quantities similar to those found in winter. (3) This state persists throughout the first period of shoot growth. (4) Some days before growth of Lammas shoots begins, the inhibitors suddenly disappear again, only to reappear before the leaves on the shoots are unfolded.

2739. SAITO, Y. **Artificial control of sex differentiation of Japanese Red Pine and Black Pine strobiles.** *Journal of the Faculty of Agriculture, Tottori University, Tottori* 3 (1), 1957 (1–29 + 4 photos). 44 refs. [E.e.] C.G.B.

Describes studies on 6-year-old *Pinus densiflora* (1) and 4- to 12-year-old *P. thunbergii* (2). By pinching off the tips or upper parts of shoots (where ♀ strobili are normally formed) just before the meiosis of the pollen mother cell in lateral strobili (normally becoming ♂), sex transition could be induced in the lateral strobili of (1) and not necessarily only on the shortened shoots. Fertilizing with $(NH_4)_2SO_4$ increased the effect. Sex transition was more difficult to achieve in (2), requiring shoot removal about a month before the meiosis period of the pollen mother cell and very often pollarding in addition. Spraying with a 10 p.p.m. aqueous solution of the Na salt of $\alpha$-NAA in some cases induced sex transition into ♀ in normally ♂ strobili. The Na salt of 2,4-D at 10 p.p.m. caused gigantic growth in ♂ strobili, and at 100 p.p.m. sex transition into ♂ of strobili normally developing into ♀s. The relative growth of parts of shoots, and the development of pH levels and C/N ratios during the growing season were investigated, and morphological and cytological studies on androgynous strobili are described. Theories of growth-regulator activity in sexual differentiation are discussed. It is suggested that if pH (indicating growth-regulator concentration) in that part of the shoot producing lateral strobili is lowered beyond a critical point (e.g. by pinching off the tip) before meiosis sets in, it is inhibited, and microspores change into macrospores. Conversely if, by earlier development, terminal strobili can complete meiosis before the seasonal fall in pH, they become ♂. [Cf. *F.A.* 21 No. 1439.]

## 163. Embryology

2740. RADFORTH, N. W., and BONGA, J. M. **Differentiation induced as season advances in the embryo-gametophyte complex of *Pinus nigra* var. *austriaca* using indole acetic acid.** *Nature, Lond.* 185 (4079), 1960 (332).

2741. NAIR, N. C. **Studies on Meliaceae. I. Floral morphology and embryology of *Naregamia alata* W. & A. II. Floral morphology and embryology of *Melia azedarach* Linn. A reinvestigation.** *J. Indian Bot. Soc.* 38 (3), 1959 (353–78). 24 + 18 refs. O.B.D.

2742. NAIR, N. C. **Studies on Meliaceae. III. Floral morphology and embryology of *Sandoricum indicum* Cav.** *Phyton, Buenos Aires* 10 (2), 1958 (145–51). 6 refs. [E.e.] C.G.B.

### 164. Morphology

See also Nos. 2741–2, 2782–4, 2791, 2801–2, 2859.

2743. Sébastian, C. Sur la phyllotaxie de *Juniperus phoenicea*. **[Phyllotaxy in *J. phoenicea*.]** *Bulletin de la Société des Sciences Naturelles et Physiques du Maroc, Rabat* 38 (4), 1958 (187–94). 3 refs. [F.]

2744. Hamilton, L. S. **Color standardization for foliage description in forestry**. *J. For.* 58 (1), 1960 (23–5). 9 refs.

Recommends that standard colour references be more widely used, so that recorded observations can have a precise and translatable meaning, and that the U.S. forestry profession adopt a single standard such as the Munsell system (coupled where necessary with descriptive colour names listed by the Inter-Society Colour Council and National Bureau of Standards) and agree upon observation conditions.

2745. Çepel, N. Meşe ve gürgen yapraklarının vejetasyon devresi zarfında büyüme seyri üzerine bir araştırma. **[Investigations on leaf area development of *Quercus robur* and *Carpinus betulus* during one growing season.]** *Istanbul Üniv. Orm. Fak. Derg.* 9*A* (1), 1959 (114–25). 6 refs. [Turk.G.]

In connexion with experiments on nutrient concentrations [see *F.A.* 20 No. 2740] a method was developed of measuring leaf area (l.a.) *in situ* on the same leaves at intervals during the growing season. The method (employing light-sensitive paper) is described. Measurements for 5 leaves each of Oak and Hornbeam were started after the leaves had become deep green (early May). Results are tabulated and graphed. In Oak, l.a. increased up to early July, but then remained virtually constant. In Hornbeam, l.a. increased by 9·5% from May to July, compared to 2% in Oak. In June and July, l.a. of Hornbeam increased only very slightly.

2746. Morretes, B. L. de, and Ferri, M. G. Contribuição ao estudo de anatomia das folhas de plantas do cerrado. **[Leaf anatomy of plants of the *campos cerrados*.]** *Boletim, Faculdade de Filosofía, Ciências e Letras, Universidade de São Paulo, São Paulo* No. 243 (*Bot.* No. 16), 1959 (7–70). 11 refs. [Port.port.e.]

The following species were examined: *Dimorphandra mollis*, *Stryphnodendron adstringens*, *Bowdichia virgilioides*, *Machaerium acutifolium*, *Sweetia elegans*, *Platypodium elegans*, *Xylopia grandiflora*, *Curatella americana*, *Qualea grandiflora*, *Connarus suberosus*, *Aspidosperma tomentosum* and *Strychnos pseudo-quina*. Features studied were: the epidermis, the stomata, the midrib area, the margin, and the area between the leaf margin and the midrib . The results are presented in detail with illustrations. The ecological significance of the findings is discussed.

2747. Gifford, E. M., Jr., and Mirov, N. T. **Initiation and ontogeny of the ovulate strobilus in Ponderosa Pine**. *For. Sci.* 6 (1), 1960 (19–25). 12 refs.

In addition to a detailed account of a study of *Pinus ponderosa*, information on dates of initiation of strobili is tabulated for *P. pumilio*, *P. strobus*, *P. rigida*, *P. nigra* var. *austriaca*, *P. nigra* var. *calabrica*, *P. edulis* and *P. elliottii*, in various parts of the U.S.A., and for *P. sylvestris* in England.

2748. Aytug, B. *Abies equi-trojani* Aschers. et Sinten est une espèce d'origine hybride d'après l'étude des pollens. **[A study of pollens shows *A. equi-trojani* to be of hybrid origin.]** *Repr.* from *Pollen et Spores, Paris* 1 (2), 1959 (273–8). 8 refs. [F.e.g.]

It is suggested that this is a hybrid of *A. bornmuelleriana* and *A. cephalonica*. [Cf. *F.A.* 21 No. 1449.]

2749. Scaramuzzi, F. Osservazioni su anomalie dei fiori in *Quercus coccifera* L. **[Anomalies in flowers of *Q. coccifera*.]** *Nuovo G. bot. ital.* (*n.s.*) 45 (1/2), 1958 (380–8). 10 refs. [It.e.] A.P.B.

Describes a case of anomalous sexual distribution and development on two trees, with bisexual inflorescences. The flowers, normally unisexual, show a strong tendency towards hermaphroditism and intersexuality. No external causes were observed and the condition is probably endogenous; its manifestations are comparable to those observed after experimental treatment with auxins.

2750. Mičev, B. Izsledvanija vărhu razmerite na šišarkite, plodovete i semenata na našite gorski vidove. **[Investigation of cone, fruit and seed dimensions of some Bulgarian forest tree species.]** *Gorsko Stopanstvo* 14 (6), 1958 (26–30). [Bulg.]

Tabulates the max., min. and mean length, width and thickness of seeds and, where applicable, cones and wings of 7 conifers, and of fruits, seeds, wings, etc. of 38 broadleaved species. Some exotics are included.

2751. Lagov, I. A. O kačestve semjan biologičeskih form listvennicy sibirskoj. **[The quality of seeds from different forms of *Larix sibirica*.]** *Lesn. Hoz.* 12 (2), 1959 (72). [Russ.]

Besides the forms with violet-red and greenish-yellow cones, differing also in seed weight, germinative energy and germinative capacity [see *F.A.* 21 No. 1472], a third form with 'bordered' cones (scales green with violet margin) occurs in the S. Altai. This form shows intermediate values for the seed properties examined and is regarded as of hybrid origin.

### 165.3/.7. Heredity, Genetics and Breeding; Variation

See also Nos. 2720, 2724, 2739, 2747–8, 2751, 2856, 2934, 2990–5, 3005–6, 3013–4, 3057–68, 3362, 3367, 3702, 3725–6.

2752. **Proceedings of the fifth Southern Conference on forest tree improvement**. School of Forestry, North Carolina State College, Raleigh. 1959. pp. 113. Many refs.

Contains 17 papers, nearly all on Southern Pines, including papers on five-year results of the Southwide geographic seed-source study (*P. C. Wakeley*) [cf. *F.A.* 15 No. 2421; 18 No. 104]; Insect and disease occurrence in this study (*B. W. Henry*) [chiefly on fusiform rust and tip-moths]; Early results of a seed-source study of Slash Pine in

Georgia and Florida (*A. E. Squillace* and *S. Kraus*) [suggesting clinal variations in growth rate, with seedlings from optimum climates often surpassing local races]; Growth and form in 5-year-old open-pollinated progeny from selected Loblolly Pine (*R. E. Goddard et al.*) [progeny of 4 out of 6 mothers were superior to controls in one or more desirable characters but not in all]; Superior tree selection, Loblolly Pine (*O. S. Peevy*) [describing field work]; ditto, Slash Pine (*F. C. Cech*) [comparing grading systems]; Variation in nursery-grown seedlings from individual mother trees in a seed-producing area (*C. L. Brown* and *R. E. Goddard*) [there was correlation of seedling size with seed size within, but not between, progenies of individual trees]; Control of cone insects by aerial spraying (*E. P. Merkel et al.*) [counting of conelets and mature cones on sample trees sprayed once or twice with 3% $\gamma$BHC in diesel oil did not reveal significant differences in survival rates over controls]; The Georgia seed certification programme (*J. C. Barber*); Specific gravity variation in Mississippi Pines (*P. W. Wheeler*) [cf. *F.A.* 20 No. 5305]; and Variations in inherent wood characteristics of Slash Pine (*S. R. Miller*) [see *F.A.* 21 No. 3728].

2753. **Abstracts of semi-formal research papers in forest genetics.** *Proc. Soc. Amer. For. 1959*, 1960 (38–40).

Abstracts of the following papers: Natural variation of *Populus tremuloides* and *P. grandidentata* in Northern Lower Michigan (*B. V. Barnes*) [cf. *F.A.* 21 No. 2771]; Geographic variation in growth responses of Ponderosa Pine (*R. Z. Callaham*); Variations in crown form attributes in populations of Douglas Fir (*R. K. Campbell*); Provenance study of Douglas Fir in the Pacific Northwest Region. I. Nursery performance (*K. K. Ching* and *D. N. Bever*); Effect of elevation and climatic factors on production and dispersal of coniferous tree pollen (*L. F. Ebell* and *R. L. Schmidt*); Some thoughts on Douglas-Fir seed orchards and their establishment (*B. C. Gerdes*); A Douglas-Fir seed orchard, first and second year observations (*T. E. Greathouse* and *V. E. Allen*); Timing of pollen application in relation to seed in *Pinus strobus* (*H. B. Kriebel*); Kinds of racial variation and their significance (*T. O. Perry*); Heritability of juvenile growth rate in Western White Pine (*A. E. Squillace* and *R. T. Bingham*).

2754. WORSLEY, R. G. **Pollen fractionation—a method of increasing the viability of pollen samples.** *Silvae Genet.* 8 (6), 1959 (173–5). 1 ref. [E.e.g.f.]

An apparatus is described, consisting of an air compressor supplying a steady flow of air to a vertical glass tube in which the pollen is placed. The air flow is varied until the dead, light grains float upwards and get carried away. Then the pressure is increased further so that all except the clogged grains and dirt are carried over into a receptacle connected to the top of the glass tube. Results are given for *Pinus sylvestris*, *P. banksiana*, *Picea breweriana*, *Pseudotsuga taxifolia*, and *Larix leptolepis*, the best results being obtained with the two latter, which have no large air sacs. In general, 30 min. at low pressure results in a doubling of the viability compared with an untreated sample. The apparatus may also be used for conditioning the pollen to a wide range of humidities, and for cleaning it. *From author's summary.*

2755. BARNER, H., and CHRISTIANSEN, H. **The formation of pollen, the pollination mechanism, and the determination of the most favourable time for controlled pollination in *Larix*.** *Silvae Genet.* 9 (1), 1960 (1–11). 13 refs. [E.e.g.f.]

Describes briefly the development of the ♂ and ♀ inflorescences of *Larix* spp. from the formation of buds in the year preceding the flowering year until fertilization. It was observed that meiosis is interrupted by low temperature and may be stimulated several days later by rising temperature, with resulting irregularities in meiotic division. This occurrence may be significant for fruiting in Larch, where alternating warm and cold periods are frequent in early spring. The unique pollination mechanism in Larch is described and a short description given of pollination mechanisms in *Pinus*, *Picea* and *Pseudotsuga*. Details are also given of a method of testing the effectiveness of controlled pollinations in Larch by counting the pollen grains caught and embedded on samples of the stigmatic flaps. The shape of the bracts and the protrusion of the stigmatic flap from behind them are considered to be more reliable criteria for receptiveness than the position of the bracts. In controlled pollinations it is recommended that all inflorescences should be pollinated several times at intervals of 1 or 2 days from the beginning of the receptive period until the inflorescences close, using pollen from more than one extraction. *From authors' summary.*

2756. MCWILLIAM, J. R. **Pollen germination of *Pinus* as affected by the environment.** *For. Sci.* 6 (1), 1960 (27–39). 43 refs.

Pollen of (*a*) *Pinus nigra* var. *austriaca*, (*b*) *P. resinosa*, and (*c*) *P. ponderosa* was germinated under a variety of conditions similar to those experienced *in vivo*. Pollen of (*a*) and (*b*) failed to germinate in micropylar fluid of (*a*), indicating that this fluid is a temporary phenomenon and not the medium for pollen germination in the ovule. Pollen germination was recorded over a pH range of 4–7, and was unaffected by the presence of light, or by severe O deficiency in the external medium. Optimum concentration of sucrose was between $0{\cdot}10M$ and $0{\cdot}01M$, which caused an increase in bifurcation, and the formation of starch grains in the pollen tubes. The extent and duration of pollen-tube growth was increased threefold by the presence of sucrose in the medium. The beneficial effect of clumping on pollen germination was demonstrated and % germination of scattered pollen cultures was increased by the addition of extracts from dead and germinating pollen. The non-specific nature of this stimulus was demonstrated by the successful germination of mixtures of pollen from two different species. *From author's summary.*

2757. BANNISTER, M. H. **Artificial selection and *Pinus radiata*.** *N.Z. J. For.* 8 (1), 1959 (69–90). 18 refs.

The variation of important economic characters in

*P. radiata* is illustrated by 3 examples: (*a*) In a random sample of 100 fourteen-year-old trees, the number of cones on the stem varied from 0 to 110. (*b*) In a similar sample, estimates of the basic sp. gr. of the juvenile wood ranged from 0·30 to 0·44. (*c*) In a 1-parent progeny trial, two progenies showed a highly significant difference in the mean branching frequency of the stem. The following comments are made on the present policy of artificial selection of *P. radiata* in New Zealand. (1) It may be unwise to select for high branching frequency. This character is merely one of several branch characters that are interrelated in a complicated fashion and that all affect timber quality. (2) A selector might place too much emphasis on vegetative vigour and particularly on height, thus passing over many individuals of high potential for the breeding programme. (3) Spontaneous selfing within the clones of a seed orchard may cause a wastage of breeding effort. In future, greater care should be taken to single out individuals that are contemporaneous in their pollination, or alternatively to select for self-sterility. (4) More use should be made of the 4 isolated local populations of *P. radiata* known to exist in the wild state, in order to increase the available genetic material. (5) It would be wise to begin the hybridization of *P. radiata* with other species. (6) Artificial selection in forestry is not the prerogative of the tree breeder. Thinning always involves artificial selection, and seed collection should also do so. *From author's summary.*

2758. Guinier, P. À propos du 'pin de montagne': un traquenard botanique pour les forestiers: les notions d'espèce et d'essence. **['Mountain Pine': a botanical trap for foresters: the botanical and the silvicultural concepts of 'species'.]** *For. France* No. 92, 1960 (7–8). [F.] X.

Discusses the difficulties caused by the use of the term 'Mountain Pine' or *Pinus mugo* to cover the whole complex from the prostrate type to the valuable Pyrenean tree (*P. mugo* var. *rostrata* or *uncinata*), e.g. Austrian seed bought for use in France produced shrubs instead of trees. [Cf. *F.A.* 14 No. 3341.]

2759. Tralau, H. [W.] Beiträge zur Kenntnis der Variabilität der Fichte. III. Farbcharakteristika. **[Variability in Spruce. III. Colour characteristics.]** *Phyton, Buenos Aires* 11 (1), 1958 (63–74). 26 refs. [G.g.] C.G.B.

Describes spectrophotometric analyses of pigments in the cotyledons of Norway Spruce seedlings with one or two *aurea* parents, including dark-green, light-green (viable) and yellow (non-viable) individuals. The quantitative relationships of chlorophyll *a*, chlorophyll *b*, and of both chlorophylls, to carotinoids—as also their changes during the first 28 days—are tabulated for 10 groups of seedlings, and the genetic significance of the findings is discussed. [Cf. *F.A.* 19 No. 4087.]

2760. Little, E. L., Jr., and Pauley, S. S. **A natural hybrid between Black and White Spruce in Minnesota.** *Amer. Midl. Nat.* 60 (1), 1958 (202–11). 19 refs. B.A.P.

Presents a comparative description of the tree, which was discovered in 1955 near Cromwell, Minn., and appears to be a first-generation hybrid. The cultivar name Rosendahl Spruce is to be associated with this Minnesota hybrid, to distinguish it from any other variations from the same parent species.

2761. Cram, W. H., Lindquist, C. H., and Martin, E. W. **Tree breeding: Spruce improvement.** *Extr.* from *Summ. Rep. Dom. For. Nursery Sta. Sask. 1959*, [1960] (11–2).

Self-, cross-, and open-compatibility were determined for 36 selections of Colorado Spruce (*Picea pungens*). Mean seed yield for self-pollination was only 11%, and that for artificial cross-pollination 41%, of that resulting from open-pollination. Three of the 36 trees proved self-incompatible and 4 were incompatible with the tester selection.

2762. Ishizaki, A., and Shimonosono, T. **[The main strains of *Cryptomeria* for [propagation by] cuttings relative to the soil character in Kyushu.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 117, 1959 (43–63). 27 refs. [Jap.e.*e*.]

Some 30 forms of Sugi [*Cryptomeria japonica*] have been distinguished round Kyushu. Of those, 9 of the main forms were selected, and their soils examined—in profile, physically and chemically—and the soil characteristics common to or distinguishing the different forms are tabulated and discussed. Conclusions as to the connexion, if any, between soil characteristics and the various forms await the results of indoor experiments now in progress.

2763. Anderson, G. W. **The search for resistance to Chestnut blight in the Lake States.** *Tech. Note Lake St. For. Exp. Sta.* No. 578, 1960. pp. 1.

A note on American attempts to develop blight-resistant Chestnut. Native stock is being crossed with the Asiatic Chestnut, and surviving Chestnut trees which may possess natural resistance are being sought out and examined.

2764. Fischer, F. Versuche an Klonenmaterial von *Castanea* sp. **[Trials with clones of *Castanea* spp.]** *Mitt. Schweiz. Anst. Forstl. Versuchsw.* 35 (7), 1959 (437–58 + 37 photos). 9 refs. [G.g.f.it.e.]

A preliminary report on infection trials with *Endothia parasitica* on 71 clones of *C. sativa* (323 plants) and 2 of *C. mollissima* (4 plants), describing propagation by layering, artificial infection by bark grafts, development of the lesions and evaluation of resistance. This and other characters (illustrated) varied greatly between clones. Only one *C. sativa* clone was rated resistant to a considerable extent.

2765. Suhanova, I. V. O nekotoryh osobennostjah rano- i pozdnoraspuskajuščihsja form duba čereščatogo. **[Some characteristics of early- and late-flushing forms of *Quercus robur*.]** *Lesn. Hoz.* 12 (1), 1959 (68–9). [Russ.]

Investigations on (*a*) early- and (*b*) late-flushing forms of *Q. robur* in the Rostov region showed that, in 5-year-old plantation-grown trees, 80% of (*a*) had knee-like bends (usually 1, but occasionally 2 or even 3) in the lowest part of the stem. In 19-year stands > 90% of (*a*) had stem bends (average 2 per tree); and in 47-year stands 97% of (*a*), but ≯ 10% of (*b*), showed bends (average 4–5 per tree). The yield of utilizable wood in (*a*) at 47 years was ≯ 15–20%, but in (*b*) 60–70%. Self-pruning, crown formation, and frost-hardiness were better in (*b*) than in (*a*). It was noted that (*a*) trees seemed to suffer more from insect damage in summer, and from severe cold in winter. Stands of (*b*) had a thicker litter layer than (*a*).

2766. Correia, C. A. da Paixão. Algumas considerações sobre as actividades relativas ao estudo do sobreiro no ano de 1958. **[Work in connexion with the study of Cork Oak in 1958.]** *Estud. Inform. Serv. Flor. Aqüic. Portugal* No. 112–*G*3, 1959. pp. 29. [Port.port.]
Gives the results of work at the Alcobaça Experiment Station in vegetative propagation, relationship between seed weight and seedling vigour, and the induction of polyploidy.

2767. Kriebel, H. B. **A prostrate mutant of Black Locust.** *J. For.* 58 (3), 1960 (222). 4 refs.
A prostrate specimen of *Robinia pseudoacacia* was recently discovered in Ohio and propagated from root cuttings in 1958 at the Ohio Agricultural Experiment Station. The tree and its ramets are quite procumbent, but no other distinguishing characteristics have yet been noted. The form has aroused interest because of its possibilities for use on strip-mined land. As a cultivated variety, its designation will be *R. pseudoacacia* 'Ohio prostrate'.

2768. Herzog, W. Steigerung der Massenleistung und Erträge durch Auswertung artbiologischer Eigenschaften bei Eukalyptus. **[Increasing volume and financial yields by attention to hereditary characters in Eucalypts.]** *Arch. Forstw.* 9 (1), 1960 (57–67). [G.g.russ.e.]
In Brazil the author found that in plantations of *Eucalyptus* (various species) *A* (superior), *I* (intermediate), and *U* (poor) individuals could be clearly distinguished, and suggests forming seed orchards from likely *A*'s and *I*'s selected in the nursery.

2769. Jovanović, B. Neka iskustva i zadaci oplemenjivanja topola kod nas. **[Experience and tasks in Poplar breeding in Jugoslavia.]** *Topola, Beograd* 3 (11), 1959 (877–93). 16 refs. [Serb.f.]
Summarizes some recent research, and discusses the setting up of a section concerned with breeding, under the Jugoslav National Poplar Commission.

2770. Sauer, E. Über die Beastungsverhältnisse von 1-jährigen Baumschulpflanzen der 16 Wirtschaftspappel-Altsorten. **[Branching in one-year-old nursery plants of 16 old-established commercial Poplar varieties.]** *Silvae Genet.* 8 (6), 1959 (161–72). 2 refs. [G.g.e.f.]
Number of branches, height of first branch from the ground, length of branches, angle between branch and stem, and height of tree were measured on 3 individuals of each of 16 varieties of *Populus* × '*canadensis*', and a statistical analysis of the data is presented and discussed.

2771. Barnes, B. V. **Natural variation and clonal development of *Populus tremuloides* and *P. grandidentata* in Northern Lower Michigan.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (5), 1959 (1511–2). O.R.S.
Features studied on 5 trees in each of 31 clones of both sexes of *P. tremuloides* and of 21 of *P. grandidentata* included total height, age, crown class, and d.b.h. Leaf samples were collected from three different shoot lengths, and phenological records made in autumn 1957 and spring and autumn 1958. The ontogeny of the clones was studied by analysing their establishment, form and structure, age, growth pattern, and root system. An excavation of the root system of one clone showed many stems connected on a complex root system, but no predictable arrangement of suckers. A wide range of interclonal variation was observed in suckering ability, growth capacity, stem form, flushing, autumn leaf colour, leaves, bark, and flower bracts. There were minor variations within clones, probably caused by environment, in gross appearance and some morphological characters. Clones whose characteristics closely resembled some 16 previously described subspecific Aspen taxa were observed on the two research sites covered by the study. Two clones of *P. alba* × *P. tremuloides*, one of *P. alba* × *P. grandidentata*, and 33 of *P. grandidentata* × *P. tremuloides* were discovered in the course of the study. General conclusions are that: (1) the clone, rather than the single stem typical of most tree species, is the typical growth habit of Aspens in Lower Michigan; (2) Aspens exhibit a surprisingly large amount of clonal variation in a number of characters even in a fragmentary part of their range; and (3) members of one clone can be distinguished readily from those of a neighbouring clone by a variety of morphological and physiological characters (e.g. sex, time of flushing, autumn leaf colour, leaf characteristics).

2772. Resnik, M. E. Germinación del polen de algunas especies del género *Salix*. **[Pollen germination in some *Salix* spp.]** [*Docum.*] *10th Sess. Int. Poplar Comm.* No. *FAO/CIP/95L* (*Add.* 3), 1959. pp. 3. [Span.] Limited distribution.
Germination experiments with *Salix caprea*, *S. babylonica* and *S. integra* showed that their requirements of sugars in the nutrient solution for optimum germination vary according to species. Optimum temperature for pollen of *S. babylonica* is ca. 16° C., and the addition of B to the substrate markedly influences germination, regardless of its concentraion. Natural longevity of *S. babylonica* pollen varies between 7 and 13 days depending on temperature, humidity, and light.

2773. Ragonese, A. E., and Rial Alberti, F. Un nuevo sauce híbrido de valor ornamental obtenido en la República Argentina. **[A new ornamental hybrid Willow obtained in Argentina.]** [*Docum.*] *10th Sess. Int. Poplar Comm.* No. *FAO/CIP/95L* (*Add.* 2), 1959. pp. 2. [Span.] Limited distribution.
Describes a new hybrid obtained in experiments at the Centro Nacional de Investigaciones Agropecuarias de Castelar, viz. *Salix matsudana* cv.'Rojoflexuoso' (*S. matsudana* f. *tortuosa* ♀ × *S. alba* var. *tristis* ♂).

2774. Richens, R. H. **Studies on *Ulmus*. III. The village Elms of Hertfordshire.** *Forestry* 32 (2), 1959 (138–54). 23 refs.

A similar study to that already made in southern Cambridgeshire [cf. *F.A.* 20 No. 1475]. The number of samples collected was 143, the majority of which fall into 9 biometrically defined groups, 7 pertaining to *U. carpinifolia* and 2 to *U. procera*. *U. glabra* was also encountered, and one putative hybrid between *U. glabra* and *U. carpinifolia*. The *U. carpinifolia* Elms occur in the east of the country and appear to be of Roman introduction in at least one case. *U. procera* appears to have been established by the end of the Middle Ages. *From author's summary.*

2775. Ozolin, G. P. Opyt selekcii il′movyh porod na ustojčivost′ k gollandskoj bolezni. **[Experiment on the selection of Elms resistant to Dutch Elm disease.]** *Vestn. sel′.-hoz. Nauki, Moskva* 4 (12), 1959 (139–42). [Russ.e.f.g.] O.W.

A brief account of Michurinist methods of selection and breeding for resistance, carried out in Central Asia since 1946. Over 2000 specimens of Elms (various hybrids and varieties) resistant to the disease have been grown and are now being used for propagation.

2776. Sharma, A. K., and Bhattacharyya, N. K. **Structure and behaviour of chromosomes of species of *Acacia*.** *Phyton, Buenos Aires* 10 (2), 1958 (111–22). 12 refs. [E.e.span.] C.G.B.

Covers 6 species with the following $2n$ chromosome numbers: *A. moniliformis*, *A. catechu* and *A. senegal*, 26; *A. farnesiana* and *A. leucophloea*, 52; and *A. arabica*, 44; including a detailed karyotype analysis and a discussion of polyploidy as a factor in species evolution. *From authors' summary.*

2777. Pantulu, J. V. **Studies on the Caesalpiniaceae. III. Cytological observations in *Cassia* species.** *Proc. Indian Acad. Sci.* 51*B* (1), 1960 (19–31). 20 refs. O.R.S.

*C. glauca*, *C. glauca* var. *suffruticosa*, *C. occidentalis*, *C. sophora*, *C. auriculata*, *C. marginata*, *C. obtusifolia*, *C. fistula* and *C. alata*.

2778. Barlow, B. A. **Chromosome numbers in the Casuarinaceae.** *Aust. J. Bot.* 7 (3), 1959 (230–7 + 1 plate). 15 refs. O.B.D.

Chromosome numbers of 37 species of *Casuarina* are reported and found to conform with a suggested division of the genus into major groups. The extra-Australian species groups are probably ancient, and are at the primary diploid level of the genus ($x = 8$ or 9). Somatic chromosome numbers ranging from 28 to 20 occur in the Australian stocks, and chromosome evolution has possibly involved an ancient polyploidy, followed by stepwise reduction in number. Later evolution in the *distyla* species group has involved no changes in the haploid chromosome number ($n = 11$), but polyploidy within the species has been frequent. *Author's summary.*

2779. Barlow, B. A. **Polyploidy and apomixis in the *Casuarina distyla* species group.** *Aust. J. Bot.* 7 (3), 1959 (238–51). 28 refs. O.B.D.

In the *Casuarina distyla* species group, which includes 13 closely related species, sexual tetraploid forms have been recorded in nine species and apomictic triploids in four.These forms are probably autopolyploids. The triploid apomicts are presumably diplosporous and parthenogenetic, and in two of the species are pseudogamous. It is suggested that a transition from the former to the latter breeding system would follow elimination of the need for pseudogamy. A hypothesis is presented that polyploidy and apomixis have arisen together within the species, through establishment in a diploid population of a triploid plant that is diplosporous and parthenogenetic. The genetic system involved probably spread through the group during the evolution of the species, giving them a potential for this kind of development. *From author's summary.*

### 166. Economic Botany (General). Useful and Harmful Plants

See also sections 4 and 8.

2780. Bąk, T., and Lewandowski, L. Wyniki badań botanicznych treści przewodu pokarmowego zwierząt podejrzanych o zatrucia roślinne. **[Results of botanical investigations on the content of the alimentary canal of animals suspected of being poisoned by plants.]** *Zeszyty Naukowe Wyższej Skoły Rolniczej, Wrocław* No. 21 (*Zootechnika* No. 6), 1959 (91–5). 5 refs. [Pol.russ.e.g.]

An account of plants found in 316 analyses. *Taxus baccata* caused 5 cases of poisoning; fruit of *Aesculus hippocastanum* 1 (a goat); and twigs and needles of *Picea abies* 1 (a horse). In the cases of Horse Chestnut and Spruce, large quantities had been eaten.

### 168. Histology

See also Nos. 2746, 2791, 3066, 3071, 3349, 3411, 3649 *et seq.*

2781. Standifer, L. C. **A study of the 'malt factor' requirement for the growth of Spruce tissue cultures.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (6), 1959 (1995). O.R.S.

In a study with *Picea abies* as the test material, it was found that the growth stimulation of the callus by malt extract or casein hydrolysate is due largely to their amino-acid contents, although other constituents probably contribute to the total effect. The growth of Norway Spruce callus, unlike that of other conifers, was inhibited by light. This and other apparent contradictions found in the literature are probably due largely to physiological differences in the species, but may also reflect differences in the basic medium, the constitution of the supplements, and other environmental factors.

2782. Seeliger, I. Zur Entwicklungsgeschichte und Anatomie wurzelbürtiger Sprosse an isolierten Robinienwurzeln. **[The development and anatomy of adventitious shoots arising on excised roots of**

***Robinia pseudoacacia*.]** *Flora, Jena* 148 (1), 1959 (119–24). 15 refs. [G.] O.B.D.

Traces, by means of microtome sections, the course of development of adventitious endogenous buds arising within the pericycle of excised Robinia roots. [Cf. *F.A.* 18 No. 2481.]

2783. SEELIGER, I. Über die Bildung wurzelbürtiger Sprosse und das Wachstum isolierter Wurzeln der Robinie (*Robinia pseudoacacia* L.). **[The formation of adventitious root shoots and the growth of excised roots in *R. pseudoacacia*.]** *Flora, Jena* 148 (2), 1959 (218–54). 70 refs. [G.g.] O.B.D.

In continuation of previous experiments, excised roots of *R. pseudoacacia* were grown in sterile culture, and various factors tested for their influence on root growth and bud formation. Differences in temperature (a range of 19–22° C. was tested), differences in pH (range 3·5–7·0) at the beginning of growth, variation in the N source, and addition of adenine and IAA, all influenced root growth. They had no effect, however, on the formation of buds, and neither did decapitation of the main root. Good lengthwise growth of the main root was obtained within the temperature range 20–28°, with a possible optimum at 23°; the higher temperatures promoted development of lateral roots. Root growth is only possible within a pH range of 4·2–4·8, with a possible optimum at 4·4. Nitrates are a more favourable N source than asparagine. $NH_4$ compounds and glutamic acid are useless Adenine (20 mg./litre upwards) inhibited growth of the main root. Addition of heteroauxin ($10^{-11}-10^{-4}$ mol) gave an optimum curve with an optimum at $10^{-10}-10^{-11}$ mol, but no extra growth of the main root compared with controls. Light, even when diffuse, had a very strong influence on bud formation. Agar culture encouraged bud formation, but not significantly. Pyridoxin (up to 1 mg./litre) furthered bud formation in cultures in the dark. Glucose encouraged it more than sucrose. A portion of the hypocotyl left on the excised root also influenced the frequency of bud formation. The observations all indicated that there is no direct connexion between root growth and adventitious bud formation from the roots.

2784. CATESSON, A.-M. Zonation apicale et origine du procambium dans les rameaux d'*Acer pseudoplatanus*. **[Apical zonation and origin of the procambium in twigs of *A. pseudoplatanus*.]** *C.R. Acad. Sci., Paris* 250 (9), 1960 (1709–11). [F.f.] O.R.S.

## 17. Systematic Botany

### 172.8. Eumycetes (True Fungi)

See also Nos. 3343 *et seq.*, 3789 *et seq.*

2785. FENNELL, D. I. **Conservation of fungous cultures.** *Bot. Rev.* 26 (1), 1960 (79–141). 336 refs.

A review of selected world literature on methods of conservation, covering periodic transfer, oil-covered slants, soil or sand cultures, drying, freezing, and freeze-drying.

2786. SMITH, A. H. ***Tricholomopsis* (Agaricales) in the Western Hemisphere.** *Brittonia, N.Y.* 12 (1), 1960 (41–70 + 7 plates). Many refs.

Descriptions of, and key to, 18 species, many of which are recorded as growing on stumps, logs, etc. in the forest.

2787. DANCE, B. W. **A cultural connection between *Venturia tremulae* Aderh. and its imperfect stage in Ontario.** *Repr.* from *Canad. J. Bot.* 37, 1959 (1139–40). 7 refs.

The author shows from cultures that *V. tremulae* is the perfect form of *Napicladium tremulae* (= *Pollaccia radiosa*).

### 174. Spermatophyta, Seed-Plants in General. Floras and Check-Lists

See also No. 2926.

2788. BOOM, B. K. Benaming, geschiedenis en kenmerken van een aantal houtachtige planten. **[Nomenclature, history and characteristics of some woody plants.]** *Jaarb. Ned. Dendrol. Ver.* No. 20, 1954–1955 (1957), (37–120 + 4 photos); No. 21, 1956–1958 (1959), (85–178). Many refs. [Du.e.]

[Cf. *F.A.* 20 No. 2834.] Genera include *Populus*, *Salix*, *Alnus*, *Carpinus*, *Fagus*, *Castanea*, *Quercus*, *Ulmus*, *Robinia*, *Acer*, *Aesculus*, *Tilia*, *Fraxinus* and *Picea*.

2789. KHALIL, M. A. K. **Name changes in plants of the Indo-Pakistan sub-continent.** *Pakistan J. For.* 9 (4), 1959 (235–66).

A revised and rearranged version of a list (by M. B. Raizada) published in *Indian For.* [cf. *F.A.*20 No. 167].

2790. TAMAYO, F., APARICIO, A., and MAXIM, P. Árboles en flor de Venezuela. **[Venezuelan trees in flower.]** Compañía Shell de Venezuela. 1959. pp. 67 + viii. [Span.]

A collection of coloured photographs of 23 trees in flower, with short botanical notes and black-and-white photographs of the leaves.

### 174.2/.7. Gymnosperms

See also Nos. 2736–7, 2748, 2751, 2760, 2926, 3653–5.

2791. LI, C.-L. **[Recent advances (1949–59) in morphology, anatomy and cytology of *Ginkgo biloba* L. (1).]** *Acta bot. sinica* 8 (4), 1959 (262–70). 45 refs. [Chin.]

A review of world literature published during the period.

2792. LAUBENFELS, D. J. DE. ***Podocarpus lucienii*, a new species from New Caledonia.** *Brittonia, N.Y.* 12 (1), 1960 (79–80). 2 refs.

The new species, a tree ca. 12 m. high, most closely resembles *P. sylvestris* and has the same general range, though the two have not been seen growing together. The note includes a Latin diagnosis and a partial key to distinguish *P. lucienii* from *P. sylvestris*, *P. costalis* and *P. thevetiifolius*.

2793. GRAY, N. E. **A taxonomic revision of *Podocarpus*, XII. Section *Macrocarpus*.** *J. Arnold Arbor.* 41 (1), 1960 (36–9). 5 refs.

[Cf. *F.A.* 20 No. 1490.] Description of *P. ustus*, a small twiggy shrub found in the mountain forests of New Caledonia.

### 176.1. Dicotyledons

See also Nos. 2741–2, 2767, 2771, 2773–4, 2776–9, 3656–62.

2794. BARKLEY, F. A. **A study of *Schinus* L.** *Lilloa* 28, 1957 (5–110). [E.span.] A.P.B.

A taxonomic study, with keys to the species and information on their geographical distribution. New species described are *Schinus o'donellii*, *S. ramboi*, *S. kauselii* and *S. engleri* var. *arenicola*. Some new combinations are also presented.

2795. VEKEN, P. VAN DER. **Anacardiaceae novae congolanae.** *Bull. Jard. Bot. Brux.* 29 (3), 1959 (227–62). [F.] O.B.D.

Includes descriptions of 11 new species of *Trichoscypha*, among them 7 tree species.

2796. WILD, H. **A revised classification of the genus *Commiphora* Jacq.** *Bol. Soc. Broteriana* (*Ser. 2*) 33, 1959 (67–100 + 2 plates). [E.]

2797. ZOHARY, M. **The species of *Capparis* in the Mediterranean and the Near Eastern countries.** *Bull. Res. Coun. Israel* 8*D* (2), 1960 (49–64).

2798. DUVIGNEAUD, P. **New and little known species from the Flora Zambesiaca area. VIII.** *Bol. Soc. Broteriana* (*Ser. 2*) 33, 1959 (101–2). [E.]

Presents some new varieties and combinations in *Monotes*, and a new species, *M. redheadii*.

2799. WOOD, C. E., JR., and CHANNELL, R. B. **The genera of the Ebenales in the southeastern United States.** *J. Arnold Arbor.* 41 (1), 1960 (1–35). Many refs.

Description of the genera of the Sapotaceae (6 genera), Ebenaceae (1), Styraceae (2) and Symplocaceae (1), that occur in the region.

2800. SPIRLET, M. **Guttiferae congolanae novae.** *Bull. Jard. Bot. Brux.* 29 (4), 1959 (319–58). [F.] O.B.D.

New tree species included are 2 species of *Harungana*, 5 of *Garcinia*, 3 of *Psorospermum*, 3 of *Pentadesma* and 1 of *Allanblackia*.

2801. CHANG, C.-T. Morfologija pyl'cy *Liquidambar* L. i *Altingia* Nor. **[Pollen morphology of *Liquidambar* and *Altingia*.]** *Bot. Ž.* 44 (10), 1959 (1375–80 + 5 plates). 22 refs. [Russ.e.]

Presents a key to the three species of *Liquidambar* [see *F.A.* 20 No. 2856], and also to *Altingia chinensis*, *A. obovata* and *A. excelsa*. Reasons are given for the opinion that these two genera should be classed as a separate family, Altingiaceae, distinct from the Hamamelidaceae.

2802. HARDIN, J. W. **Studies in the Hippocastanaceae, V. Species of the Old World.** *Brittonia, N.Y.* 12 (1), 1960 (26–38). Many refs.

Completes the account of the family [cf. *F.A.* 19 No. 2757] with a key to and descriptions of the 6 Old-World species of *Aesculus*, together with notes on morphology and anatomy and possible phylogeny.

2803. MANNING, W. E. **The genus *Juglans* in South America and the West Indies.** *Brittonia, N.Y.* 12 (1), 1960 (1–26). 46 refs.

A revision, with key, based on study of all the collections in the principal herbaria of the world. Six species are recognized (all of the section *Rhysocaryon*), including *J. venezuelensis* and *J. soratensis* spp. nov., the latter from Bolivia. A tabular comparison of the species and chief varieties of the section *Rhysocaryon* and a note on some apparent hybrids are also included.

2804. JARRETT, F. M. **Studies in *Artocarpus* and allied genera, IV. A revision of *Artocarpus* subgenus *Pseudojaca*.** *J. Arnold Arbor.* 41 (1), 1960 (73–109).

[Cf. *F.A.* 21 No. 1505.] Key to the species in the subgenus, and descriptions of 10 species and 4 varieties.

2805. HAUMAN, L., and LÉONARD, J. Un nouveau parasolier montagnard d'Afrique centrale: *Musanga leo-errerae* Hauman et J. Léonard (Moracée). **[A new mountain species of *Musanga* from Central Africa: *M. leo-errerae* Hauman et J. Léonard (Moraceae).]** *Bull. agric. Congo Belge* 51 (1), 1960 (61–73). [F.f.du.]

Describes the new species, compares its habitat with that of *M. cecropioides*, and provides a key to distinguish the two species.

2806. ZIMMER, W. J. **How easy are our Eucalypts?** *For. tech. Pap. For. Comm. Vict.* No. 2, 1959 (19–20). 1 ref.

Briefly considers the effects of systematics on the field forester and the possible steps to help him in his conception of the species with which he works. *Eucalyptus* name changes have involved 11 species in Victoria to date, and, for field purposes, usage based on Ferguson's 'Handbook of Forestry' [see *F.A.* 19 No. 2561] is recommended.

2807. GARDNER, C. A. **Trees of Western Australia. The Warted Yate (*Eucalyptus megacornuta* C. A. Gardn.). The Crowned Mallee (*Eucalyptus coronata* C. A. Gardn.). The Bullich (*Eucalyptus megacarpa* F. Muell.). The Bell-fruited Mallee (*Eucalyptus preissiana* Schua.).** *Bull. Dep. Agric. W. Aust.* No. 2660, 1959. pp. 8.

Notes on distribution, and botanical descriptions.

2808. EYDE, R. H. **The discovery and naming of the genus *Nyssa*.** *Rhodora* 61 (728), 1959 (209–18). 25 refs. O.B.D.

Gives a brief survey of the history of the first descriptions and collections of *Nyssa*, its introduction into Europe, and the derivation of the name.

2809. HOWARD, R. A. **Studies in the genus *Coccoloba*, VIII. Nomenclatural changes.** *J. Arnold Arbor.* 41 (1), 1960 (40–6).

[Cf. *F.A.* 21 No. 1509.] The changes concern *C. novogranatensis*, *C. nitida* and *C. guianensis*.

2810. HUANG, C.-C. **[Preliminary study on Chinese Rutaceae (2).]** *Acta phytotax. sinica* 7 (4), 1958 (329–55 + 5 plates). [Chin.]

Deals with the Toddalieae, including a key to and distribution map of *Phellodendron*, descriptions in Latin of new varieties of *P. chinense*—viz. *P.c.* var. *glabriusculum*, *P.c.* var. *omeiense* and *P.c.* var. *yunnanense*, and distribution maps of *Toddalia*, *Acronychia* and *Skimmia*.

2811. **Nomenclature and registration [of Poplar hybrids of the Section *Aigeiros*].** [*Docum.*] *10th Sess. Int. Poplar Comm., 1959* No. *FAO/CIP/97*, 1959. pp. 5. [E.]

Includes an annexe by *J. Pourtet*, tracing the history of nomenclature, refuting recently advanced arguments in favour of *Populus* × *canadensis*, and concluding that the correct name for the group should be *Populus* × *euramericana* Guinier [cf. *F.A.* 19 No. 146].

2812. MÜLLER, R. Altstammsorten der Schwarzpappelbastarde (IIp). Die 'Marilandica'-Pappel. **['Old stock varieties' of Black Poplar hybrids (IIp). The 'Marilandica' Poplar.]** *Holz-Zbl.* 86 (31), 1960 (477–9). 23 refs. [G.]

This variety, though readily distinguishable, had also been going under the names 'deltoides', 'nigra', 'grandifolia', 'canadensis grandifolia', 'fremontii' and 'charkowiensis'. In the nursery trials at Brühl no differences were detected as between provenances, but differences caused by type of cutting (from crown or epicormic shoots, with or without terminal bud) and nursery treatment are particularly marked in this variety. It is resistant to bacterial canker, fairly resistant to *Dothichiza populea* and rust, and is tolerant of comparatively dry sites, but has the disadvantages of slow growth and poor form.

2813. WILD, H. **New and little known species from the Flora Zambesiaca area. VII.** *Bol. Soc. Broteriana* (*Ser. 2*) 33, 1959 (35–45). [E.]

Includes a description of a new tree species, *Cola mossambicensis*.

2814. NEVLING, L. I., JR. **A revision of the genus *Daphnopsis*.** *Ann. Mo. Bot. Gdn.* 46 (4), 1959 (257–363). O.B.D.

### 18. Plant Ecology

2815. SUSMEL, L. Le sugherete del Marocco: criteri della moderna ricerca di biologia forestale. **[The Cork Oak forests of Morocco: criteria for modern research in forest biology.]** *Monti e Boschi* 11 (1), 1960 (15–27). [It.f.e.]

Summarizes the work of de Beaucorps, Marion, and Sauvage on the forest of Mamora [cf. *F.A.* 20 No. 1521], adding some comments by the present author, a number of photographs, and a discussion of the bearing of this work on the management of Italian Cork Oak stands.

### 181. Mode of Life, Autecology. Silvicultural Characters of Trees

See also Nos. 2718, 2947, 2971, 2975–6, 2984, 3187, 3587.

2816. DAUBENMIRE, R. F. **Plants and environment: textbook of plant autecology.** John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London. 2nd ed. (rev.) 1959. pp. xi + 422. 773 refs. Price £2. 16*s*. [Cf. *F.A.* 10 No. 1630.]

2817. MERENDI, A. L'abete rosso in Italia (*Picea excelsa* Link.). **[*Picea abies* in Italy.]** *Ital. agric.* 97 (2), 1960 (163–73). [It.] E.M.B.

A short account of its distribution, silvicultural treatment, protection etc.

2818. *Pinus khasya* Royle. Caractères sylvicoles et méthodes de plantation. **[*P. khasya*. Silvicultural characters and plantation methods.]** *Bois For. Trop.* No. 69, 1960 (27–32). 12 refs. [F.]

A general account of *P. khasya* [including *P. insularis*], with literature references, and information on morphology, wood properties, ecology and plantation technique (particularly in the Philippines).

2819. MAGIC, D. Rakytník rešetliakovitý (*Hippophaë rhamnoides* L.) a jeho využitie. **[*H. rhamnoides* and its utilization.]** *Lesn. Čas.* 5 (6), 1959 (409–31). 6 refs. [Slovak.]

Covers morphology, ecology, distribution, propagation, plantation establishment, etc.

2820. RUPÉREZ CUÉLLAR, A. La encina y sus tratamientos. **[*Quercus ilex* and its silviculture.]** Gráficas Manero, Madrid. 1957. pp. 154 + 2 plates. 125 refs. [Span.f.e.g.]

A comprehensive handbook on the growing of *Q. ilex*, giving information under the following heads: systematics, distribution (with particular reference to Spain), ecology, physiology, associated species, exploitation (for fodder, firewood, charcoal, timber, tannin and acorns), management, artificial regeneration, pruning, and control of pests and diseases.

2821. HANEY, G. P., and METZ, L. J. **Silvical characteristics of Southern Red Oak (*Quercus falcata* Michx.).** *Sta. Pap. Stheast. For. Exp. Sta.* No. 106, 1959. pp. 9. 14 refs.

2822. POHL, Z., and STECKI, Z. Topola szara w Wielkopolsce. **[The Grey Poplar in Wielkopolsce [National Park?].]** *Arboretum Kórnickie, Poznań* No. 4, 1959 (109–22). 18 refs. [Pol.russ.e.*e*.]

*Populus canescens* is found in 9 localities, in 5 of which it forms small stands. The composition, age, and growth relations, ground vegetation, and soil of these stands are described. It is concluded that 4 of the stands are natural; that *P. alba* may serve as an indicator species in searches for *P. canescens*; that *P. canescens* forms communities with a strongly developed shrub layer; that in young stands it favours the growth of *Fraxinus excelsior*, and is not impeded by *Carpinus betulus* and other shady species; and that it grows best on soils suitable for *Quercus robur*.

2823. *Khaya senegalensis* Jussieu. *Khaya grandifoliola* de Candolle. Caractères sylvicoles et méthodes de plantations. **[*K. senegalensis* and *K. grandifoliola*: silvicultural characters and plantation techniques.]** *Bois For. Trop.* No. 68, 1959 (15–20). 8 refs. [F.]

A general account for these species.

2824. Suliman, A. el G. M., and Jackson, J. K. **The Heglig tree (*Balanites aegyptiaca* (L.) Del.).** *Sudan Silva* 9 (1), 1960 (63–6).

Silvicultural characters, wood properties and uses, and uses of the fruit and kernels.

### 181.1. Distribution, Natural Range

See also Nos. 2902, 2921, 3929.

2825. Fijałkowski, D. Wpływ niektórych czynników ekologicznych na rozmieszczenie drzew leśnych w województwie lubelskim. **[Influence of some ecological factors on the distribution of forest trees in the Lublin district.]** *Ann. Univ. M. Curie-Skłodowska, Lublin* 11*C* (11), 1956 (1959), (315–414 + 1 tbl.). 60 refs. [Pol.russ.e.*russ.e.*] C.G.B.

2826. Somora, J. Príspevok k rozšireniu lipy vel'kolistej—*Tilia platyphylla* Scop., bresta horského—*Ulmus montana* Stokes a javora mliečneho—*Acer platanoides* L. v Tatranskom národnom parku. **[The distribution of *T. platyphyllos*, *U. glabra* and *A. platanoides* in the Tatra National Park.]** *Lesn. Čas.* 5 (6), 1959 (379–96). 14 refs. [Slovak. russ.g.] [Cf. *F.A.* 20 No. 4247.]

2827. Izdebski, K. Wstępne badania nad ekologią i rozmieszczeniem dębu szpułkowego (*Quercus robur* L.) w Polsce. **[Preliminary investigation into the ecology and distribution of Q. *robur* in Poland.]** *Ann. Univ. M. Curie-Skłodowska, Lublin* 11*C* (12), 1956 (1959), (415–506 + 3 tbls., 1 dgm.). 83 refs. [Pol.russ.e.] C.G.B.

A far more detailed version of work already noticed [cf. *F.A.* 20 No. 2908]. It is concluded that the distribution is determined by the soil moisture content or by the level of the water table; the degree of vigour is determined mainly by edaphic, and to a lesser degree by climatic, factors; natural regeneration depends largely on the biotic factors.

2828. Ingelsby, B. **Distribution of the Tulip Tree (*Liriodendron tulipifera* L.) in southwestern New York.** *Amer. Midl. Nat.* 59 (2), 1958 (397–417). 21 refs. B.A.P.

A study of representative stands was made within a 27-mile radius of Dunkirk. The chief associates of *L. tulipifera* in these stands are *Acer saccharum*, *Fagus grandifolia*, *Fraxinus americana*, *Betula lutea*, *Tsuga canadensis* and *Quercus borealis*. The stands in which *L. tulipifera* is well represented range from 840 to 1000 ft. alt. It was not found above 1500 ft. All the stands are on S.- or W.-facing slopes above flowing streams. The tree seems to prefer gently rolling or hummocky topography and avoids steep slopes. The best sites are on moderately well drained soils having an abundance of organic cover. Neither plant associations nor soil conditions appear adequate to explain the presence of *L. tulipifera*. Local climatic conditions seem to be the chief factor in explaining its discontinuous distribution in widely scattered areas. Each of the stands is situated in a type of valley bordering a stream that drains into Lake Erie. These depressions act as channels through which warm moist air currents flow southward from the lake. The resulting slight modifications of local climate are probably enough to account for the presence of the Tulip Tree, which thrives in the same general habitat that formerly favoured *Castanea dentata*, and is replacing this species in the forest composition. In stands where competition for light is severe, the Tulip Tree cannot compete with shade-tolerant species such as *Acer saccharum* and *Fagus grandifolia*. On forest margins, on open sites, and in young stands, its rapid growth and great size ensure it a place in the forest community. With selective management it could be made to spread and develop in suitable areas in south-western New York. *From author's summary.*

### 181.2. Atmospheric Relations. Acclimatization

See also Nos. 2685, 2727–8, 2734, 2827–8, 2842, 2871, 2880, 2882, 2902, 2975 *et seq.*, 3255 *et seq.*, 3671.

2829. Numata, M., Mitsudera, M., and Ogawa, K. **[Habitat conditions of the Bamboo forest. Ecological studies on the Bamboo forest in Japan, V.]** *Repr.* from *Journal of the College of Arts and Sciences, Chiba University* 2 (2), 1957 (162–71). 11 refs. [Jap.jap.e.*e.*]

Of the factors studied in relation to the distribution of *Phyllostachys reticulata*, the most significant proved to be extremes of air temperature [0 to − 26° C.], the wind velocity and % of stormy days, rainfall, and the deviations of temperature from the annual mean for Sado shima Island. In southern regions Bamboo may grow well on N. slopes and in northern regions on S. ones. The primary factor limiting a Bamboo species may differ from that for its local distribution: e.g. wind is considered primary on the local environmental scale but only secondary in the general environment. Tabulated results are given of studies on depth, particle size and pH of soils, on light intensity, air and soil temperature, humidity, and soil moisture content. The effect of these on the density and growth [height and weight] of *P. reticulata* is discussed. *From authors' summary.*

2830. Bieleski, R. L. **Factors affecting growth and distribution of Kauri (*Agathis australis* Salisb.). I. Effect of light on the establishment of Kauri and of *Phyllocladus trichomanoides* D. Don. II. Effect of light intensity upon seedling growth. III. Effect of temperature and soil conditions.** *Aust. J. Bot.* 7 (3), 1959 (252–94). 26 + 23 + 45 refs. O.B.D.

(I) A method for determining the effect of light on seedling distribution in the field is described. It can be applied with seedling frequencies as low as

1 per sq. m. The frequency distribution of light intensities occupied by seedlings in a quadrat is compared with the frequency distribution of light intensities measured on a grid in the quadrat. This method was used to study the effect of light intensity on the establishment of Kauri and *P. trichomanoides* in the 'nursery community', a semi-natural *Leptospermum scoparium*/*L. ericoides* associes. Neither occurred at light intensities below 0·015 and 0·018 of full daylight respectively. This limitation appeared to be due to limitation of photosynthesis by the low light intensity. Kauri, but not *P. trichomanoides*, also showed a high-light-intensity limit, at 0·30 of daylight, above which seedlings did not become established. Reasons are given for considering this as an indirect effect, probably through related solar heating affecting soil temperature or moisture. The optimum light intensity for seedling establishment of both species was close to the modal light intensity under the *Leptospermum* community: *Leptospermum* spp. were incapable of regenerating under their own cover. These two reasons appear to explain the suitability of the *Leptospermum* community as a nurse crop for the two species of conifer seedling.

(II) The effect of various light intensities is described. Daylight was screened to the required level with lath screens. There was no significant effect on seedling mortality in the light-intensity range 0·40–0·02 of full daylight. Seedling morphology was affected by light intensity, the ratios stem-dry-weight/root-dry-weight, stem-length/root-length, and fresh-weight/dry-weight, increasing significantly with decreasing light intensity. Seedling growth was a linear function of the logarithm of light intensity, the growth rates and assimilation rates being similar to those for other forest tree seedlings. The compensation point was at 0·009 of full daylight, close to the low-light-intensity limit to seedling establishment in the field, but low compared with those of other tree seedlings. There was no high-light-intensity limit to seedling growth, such as that shown for seedling establishment in the field. The apparent discrepancy is discussed.

(III) Kauri seedlings were grown under controlled conditions of temperature, soil moisture, and exposure to mycorrhizal infection. High temperatures inhibited root growth; seedlings exhibited a growth optimum at 23–26° C.; the evidence suggested that both trees and seedlings became dormant when the maximum temperature fell below 17°. Seedlings were generally resistant to both waterlogging and drought: waterlogging caused a decrease in root length and branching, but did not affect root weight; drought increased root development at the expense of the stems. In the field, seedlings were liable to be killed by drought in the first few months of growth. The 'high-light-intensity limit' to seedling establishment previously observed in the field was apparently caused by greater solar radiation increasing soil desiccation during this critical period. Seedlings grown in sterile soil and those exposed to mycorrhizal infection showed no significant differences. The autecology of Kauri is discussed in the light of current knowledge. The altitudinal and latitudinal limits could be caused by temperature limiting the rate of growth and also the length of the growing season. Kauri appears to occur preferentially on ridge-top sites because of its tolerance of poor soils and its resistance, once established, to drought. The inability of Kauri seedlings to become established under cover of the mature tree is thought to be caused by root competition. Kauri is no longer regarded as a seral stage in the development of a hardwood climax, but as one component of a 'regeneration complex'. *From author's summaries.*

2831. LIN, W.-F., LIN, W.-C., and LU, J.-L. [LÜ, C.-L.] **[Studies on the light intensities required for growth of seedlings of Taiwan Red Cypress (*Chamaecyparis formosensis* Matsum.).]** *Bull. Taiwan For. Res. Inst.* No. 55, 1958. pp. 26. 7 refs. [Chin.chin.e.*e.*]

Nine classes of light intensity (l.i.) were studied: 4, 9, 16, 25, 36, 49, 64, 81 and 100%. Statistically evaluated results showed that mean height growth after 1 year was best with 64% l.i.; and mean diameter growth and mean growth of branches, leaves and root systems, with 100% l.i. Differences in optimum l.i. at 750 and 1350 m. alt. at different seasons were determined. There was a significant positive correlation between sunshine and the growth of diameter, branches, leaves and roots of seedlings; also a significant negative correlation between air temperature and total growth at 750 m. alt., and a non-significant positive correlation at 1350 m. There was a significant positive correlation between soil temperature and total growth of seedlings at both altitudes, a significant negative correlation between r.h. and total growth at 750 m. alt., and a significant positive correlation at 1350 m.

2832. LOGAN, K. T. **Some effects of light on growth of White Pine seedlings.** *Tech. Note For. Br. Can.* No. 82, 1959. pp. 20. 19 refs.

With seedlings grown in full light (100%) as control, 4-year-old *Pinus strobus* seedlings were grown for 4 years under shelters (lath, wire cloth, and aluminium saran) passing 14, 19, 22 and 55% of full light. The effect of the shelters on air and soil temperature, soil moisture, and evaporation are discussed, but variations in these factors are considered of minor importance compared with those of light. Half the seedlings were pruned to reduce the variation in crown size in seedlings,but this had little effect on their growth [cf. *F.A.* 21 No. 491]. Height growth increased with increasing light up to the 55% level, the increase being most rapid at lower light levels; seedlings in 100% light were not significantly taller than those in 55%. Leader and root-collar diameters and branch length increased with increasing light up to 100%, although differences in branch length between 55 and 100% were not significant for pruned seedlings. Light effect on needle length was not consistent, but needles were usually longest in least light. Oven-dry weight of both tops and roots increased with light up to 100%, increases beyond 55% light being due to diameter and branch growth rather than to height. It is concluded that seedlings can be grown at a level of light (ca. 50%) that will discourage weevil activity without significant loss of height growth.

2833. Péter-Contesse, J. Essences de lumière, essences d'ombre. **[Light-demanders and shade-bearers.]** *Forêt, Neuchâtel* 13 (6), 1960 (164–7). [F.]

A study to elucidate crown development in Oak and Beech. On an Oak twig from the top of a tree, 83 buds had formed in 8 years, but only 10 shoots remained. Many of the buds, including some terminal buds, never developed. On a comparable Beech twig from the same stand, all 22 buds had developed, and only the 2 oldest had died from lack of light. Elongation was greater in Beech than in Oak in all years but two.

2834. Kryžanovskij, K. V. Značenie svetovogo režima dlja rosta duba. **[The significance of the light regime for the growth of Oak.]** *Lesn. Hoz.* 12 (2), 1959 (70–1). [Russ.]

Observations were made in Shipov Les, Voronezh, on the duration of direct sunlight received in May–June by the tops of young Oaks [age not stated] under an older stand (at various distances from its margin), and in clearings. With $< 1$ hr./day, the Oak died; with 1–4 hr./day, it grew poorly; with 4–10 hr./day, it grew normally, increment being related to the amount of insolation received; with $> 10$ hr./day, fresh leader growth in July and even August was noted. Silvicultural treatment should provide the possibility of $\nless 10$ hr. sunlight/day on the tops of young Oak, the stem and lower parts of the crown remaining in shade.

2835. Jahnel, H. Über Frostresistenz bei Waldbäumen. **[Frost hardiness of forest trees.]** *Arch. Forstw.* 8 (8), 1959 (697–725). 79 refs. [G.g.russ.e.]

Discusses the physiology of frost hardiness, on the basis of extensive literature (chiefly in German), and the behaviour of German species and exotics in the 1928–29, 1955–56, and other severe winters, including unpublished observations by the author and others. [Cf. *F.A.* 20 No. 3278.]

2836. Sakai, A. **Survival of the twig of woody plants at − 196° C.** *Nature, Lond.* 185 (4710), 1960 (393–4). 6 refs.

Describes experiments with twigs of Mulberry, *Salix koriyanagi*, and *Populus sieboldii*, in which all the easily freezable water was drawn off by sufficient extra-cellular freezing at − 30° C. After such pre-freezing, the twigs were uninjured by very low temperatures (immersion in liquid N), and it is concluded that frost injury to woody plants is not due to the low temperature *per se*. [Cf. *F.A.* 21 No. 215.]

2837. Sakai, A. **Relation of sugar content to frost-hardiness in plants.** *Nature, Lond.* 185 (4714), 1960 (698–9). 2 refs.

In artificial frost-hardening of the parenchyma cells in cortex of *Morus alba* with a constant length of hardening period, the lower the temperature to which the material was exposed, the more effective was the hardening treatment. At a definite temperature, a relatively longer period of the treatment was more effective than shorter ones, within certain limits. In all these experiments, the increase in frost-hardiness of parenchyma cells was closely proportional to that in their sucrose concentration (s.c.), but was not accompanied by any increase of their soluble protein, provided that they were artificially chilled. Further experiments have now been made, and are here described in some detail, to distinguish the effect of low temperature itself and that of the increase in s.c. The results indicate that, at least in *M. alba*, low temperature of itself has no direct effect on the increase in frost resistance, but the increase of s.c. may be a primary factor in frost hardiness. Another experiment was made, with twigs of *Gardenia jasminoides*, to determine whether the increase of s.c. in plant cells directly results in an increase in frost hardiness. It was found that, in twigs stood in a glucose solution (0·7*M*) at 25° C. for 24 hr., osmotic concentration in leaf cells after treatment was 1·20 *M*, vs. 0·7 *M* for controls treated in the same way but in plain water. Sugar content of leaves was 0·036 vs. 0·018, and % survival, after freezing for 24 hr. at − 10° C., 100 vs. 0.

2838. Junghans, B. Über den jahreszeitlichen Gang der Frosthärte verschiedenaltriger Nadeln von *Picea abies* (L.) Karsten im Hügelland. **[The seasonal fluctuations of frosthardiness in needles of different ages on *P. abies* in [medium-altitude] hill country.]** *Arch. Forstw.* 8 (4), 1959 (285–336). 83 refs. [G.g.russ.e.]

Describes experiments in which twigs were taken periodically, from summer 1952 to spring 1955, from a young stand near Tharandt, and exposed to low temperatures in the laboratory for 3 hours. Some tests were also made with twigs of different provenances growing at Tharandt, and from a stand at 900 m. alt. The critical temperature causing 50% needle mortality in the laboratory was lowest in mid-Jan. and early Feb. The rise in critical temperature in spring varied greatly with the weather. The lowest temperature tolerated under these sudden exposure conditions was −17° C. while at the same time outside temperatures of −22° were tolerated without injury (outside temperatures of −28° had caused serious frost damage in the previous year). First-year needles increased in resistance slowly during summer and rapidly during autumn, reaching parity with the older needles about November and generally surpassing them until April, though they seem to lose resistance faster in mild weather, so that in some instances they were less resistant than the older ones in spring. Shade needles appeared to be less hardy than light needles. Needles from the higher site were only slightly hardier. In the provenance trial, alpine Spruce from Grisons was generally hardier than Spruce from the lowlands of Siberia, but its tolerance decreased rather rapidly in response to early warm weather. A local provenance, from a frost pocket, had an annual curve more suited to the frequently fluctuating temperatures of early spring. Except for the immediate flushing period, no clear correlation between water content, osmotic value, and sugar contents was observed. Osmotic values and sugar and Ca contents of the young needles increased with age, while K content and acid contents decreased. All these values were, however, masked by diurnal fluctuations. The alpine provenance had the highest and the lowland provenance the lowest sugar content, and vice versa for acid. [Cf. *F.A.* 13 No. 3942; 16 No. 205.]

### 181.3. Water, Soil and Root Relations

See also Nos. 2827–30, 2857.

### 181.31. Water Relations

See also Nos. 2636–7, 2665–8, 2672–8, 2722–8.

2839. MILTHORPE, F. L. **Water relationships of plants in arid and semi-arid conditions.** *Nature, Lond.* 185 (4711), 1960 (435–6).

A review of the symposium, organized by Unesco and held in Madrid during Sept. 1959. The discussions will be published in two parts: (1) reviews of research prepared as background material; (2) proceedings of the symposium, including ca. 40 papers on detailed aspects of the subject.

2840. CHRIST, J. C. **A study of Yellow Birch (*Betula lutea*) in the bogs of Hasca Park, Minnesota.** *Amer. Midl. Nat.* 61 (2), 1959 (480–4). 9 refs. B.A.P.

Describes three isolated stands of Yellow Birch found in bogs near Lake Itasca. Its presence here in a boggy habitat, and absence on upland sites, is in contrast to its general behaviour throughout the main parts of its range.

### 181.32/34. Soil and Nutrient Relations

See also Nos. 2643–8, 2655, 2657, 2726, 2730–1, 2762, 2862, 2956, 3033–41, 3087–90, 3106–7, 3129 *et seq.*, 3171, 3266–8.

2841. HUSCH, B. **Soil moisture and temperature patterns on four White Pine sites in Southeastern New Hampshire.** *Sta. tech. Bull. N.H. Agric. Exp. Sta.* No. 98, 1958. pp. 31. 24 refs.

Soil moisture and temperature to a depth of 48 in., water-table levels, precipitation, and air temperatures were recorded over 3 years on 4 plots in young, natural, even-aged *Pinus strobus* stands on sandy soil varying somewhat in texture and markedly in both drainage and stand density. Rise and fall of available moisture varied in degree rather than in pattern, the fluctuations being greatest in the upper 1–2 ft. of the wetter plot (their lower levels remaining saturated). The driest site never exceeded 40% of maximum available moisture, and all reached wilting point to varying depths. Temperature patterns were similar on all plots, with differences attributable to topography, soil moisture and vegetative cover.

2842. HUSCH, B. **Height growth of White Pine in relation to selected environmental factors on four sites in Southeastern New Hampshire.** *Sta. tech. Bull. N.H. Agric. Exp. Sta.* No. 100, 1959. pp. 42. 73 refs.

Leader growth was measured at weekly intervals for 3 years on 20 trees on each of 4 plots [see preceding abstract]. Initiation of growth was controlled by interaction of temperature and photoperiod, and cessation by photoperiod and soil moisture. Seasonal growth patterns were similar for all plots, with a maximum in June, but total patterns varied. The relationship was complex, as the wetter plots, having a higher water table, had a shallower root system. As most of the growth took place before water became a limiting factor, growth differences were less than differences in moisture regime, and the influence of the weather was great, thus the wettest plot (*A*) ranked first in mean growth in one year and fourth in two, while the driest (*D*) was respectively fourth, third and second. (*C*) was best, coming first twice and second once.

2843. **Mineral nutrition of trees: a symposium.** *Bull. Duke Univ. Sch. For.* No. 15, 1959. pp. viii + 184 + 6 plates. Many refs.

Includes the papers (with discussions) presented at a conference held at Duke University on 4–5 Dec. 1958. The following papers are printed (number of literature references given after author's name): The determination of macro-element requirements of forest trees (*H. A. Fowells*; 25); Evaluating the micronutrient requirements of trees (*H. L. Barrows*; 22); The use of radio isotopes in mineral nutrition studies (*N. S. Hall*); The study of mineral requirements of excised tree roots (*R. L. Barnes*); Nutrient deficiency symptoms in U.S. orchards (*N. F. Childers*); Plant tissue analysis. Part I. Some factors in sampling and analyses for the diagnosis of nutritional status of trees. Part II. Observations on antagonistic effects in leaf analysis (*J. C. Cain*; 21); Plant and soil analysis in the evaluation of micronutrient element status (*K. C. Beeson*; 24); Physiological aspects of research on inorganic nutrition of trees (*P. J. Kramer*; 12); The biochemical role of iron in plant metabolism (*H. J. Evans*; 66); The role of mycorrhizae in the mineral nutrition of trees (*E. Hacskaylo*; 22); Some observations on statistical and mensurational aspects of field studies of tree nutrition (*F. X. Schumacher*); Nutrient source materials for tree nutrition studies (*G. Stanford*; 41); Horticultural viewpoints on field experiments in tree nutrition (*W. E. Ballinger*); Agronomic viewpoints on field experiments in tree nutrition (*E. T. York, Jr.*); A review of current [U.S.] Federal and State research programs in forest tree nutrition research (*W. T. Doolittle*; 4); Tree nutrition research by forest industries (*J. W. Johnson*); The status of research in inorganic nutrition of trees at colleges and universities in the United States (*M. B. Applequist*).

2844. SWAN, H. S. D. **The mineral nutrition of Canadian pulpwood species. 1. The influence of nitrogen, phosphorus, potassium and magnesium deficiencies on the growth and development of White Spruce, Black Spruce, Jack Pine and Western Hemlock seedlings grown in a controlled environment.** *Woodl. Res. Index Pulp Pap. Res. Inst. Can.* No. 116, 1960. pp. 66. 20 refs.

More or less clearly defined visible deficiency symptoms were induced and photographed in colour [photographs included as an appendix]. Fifteen weeks after the sowing, some of the seedlings were weighed and analysed (results tabulated). The data show the nutrient composition and dry weights of the seedlings to be highly dependent on the nutrient concentrations in the feed solutions, and help to determine the concentrations of these elements within the seedling that indicate deficient, optimum and excess supply.

2845. WEHRMANN, J. Mineralstoffernährung von Kiefernbeständen in Bayern. [**Mineral nutrition of Pine stands in Bavaria.**] *Z. PflErnähr. Düng.* 84 (1/3), 1959 (271–9). 20 refs. [G.g.e.f.] O.R.S. [Cf. *F.A.* 21 No. 233.]

2846. KRAUSS, H. H. Beitrag zur Kenntnis der Wechselbeziehungen zwischen den Hauptnährstoffen Stickstoff, Phosphorsäure und Kali bei der Düngung von Forstpflanzen. [**The interaction of the main nutrients N, P and K in the fertilizing of forest plants.**] *Arch. Forstw.* 8 (6/7), 1959 (592–649 + 1 tbl.). 22 refs. [G.g.russ.e.]

Describes 2 years' development of *Populus × berolinensis* cuttings (cut back after the first year) grown in open drain-pipes 30 cm. wide and 1 m. long, buried in the soil, and filled with a poor, sandy soil to which had been added an NPK fertilizer, only one element of which was varied in 5 steps (N from 0 ($N_0$) to 480 ($N_5$) kg./ha. and P and K both from 0 to 800). Greatest height in the second year was reached by the $P_5$ plots, followed by $K_5$, while the $P_0$ to $P_2$ plots were shorter than controls. Considerable initial checks (growth being less than controls) were suffered in all but the $N_0PK$ plots. The best result in the N series was with small doses (40–80 kg.), larger doses reducing the growth below that of the $N_0PK$ plot. The effect of N in the second year was small, that of K much greater in the second than in the first year, while $P_3$ to $P_5$ progressively improved growth in both. Tests with a balanced NPK fertilizer at varying depths indicated that applications at increasing depths progressively reduced, and at 80–100 cm. practically eliminated any initial setback. These latter plots ranked third after the $P_5$ and $K_5$ plots. Field trials with *P. × vernirubens* in which, *inter alia*, basic slag was added to the treatment, confirmed the findings of the pot tests. Best results were obtained when NPK + basic slag were mixed with the soil of the A horizon and placed at the bottom of the planting holes, with soil from the B horizon on top. NPK, or N alone, placed in the top of the pot caused considerable losses. Even the best plants in these field trials on poor, acid, rather dry sites hardly reached 50 cm., indicating that soil amelioration for Poplar cultivation was not practicable. In the course of the discussion of the design and evaluation of complex interaction experiments, field tests with *Alnus glutinosa* and *Pinus sylvestris* seedlings are briefly described, in which the adverse effect of N and particularly of unsuitable ratios of N, P, and/or K was demonstrated.

2847. HÖHNE, H. Vergleichende Untersuchungen über Mineralstoffgehalt, Stickstoff-Aufnahme und Trockensubstanzproduktion von Waldbodenpflanzen. [**Comparative investigations into the mineral content, N uptake and dry-matter production of forest ground flora.**] *Angew. Chem.* 71 (21), 1959 (677). [G.] O.R.S.

The mineral and N content of 65 species of the forest ground flora were studied in a uniform section of the Tharandt forest, with a basic rock of Freiberg grey gneiss. The production of organic substances per ha./year by the ground vegetation, and the quantity of nutritive substances it contained, were also determined.

2848. GEMEINHARDT, H. Bodenmikrobiologische Beiträge zum Robinienproblem. 1. Mitteilung. [**Soil microbiology in relation to the Robinia question. 1st communication.**] *Arch. Forstw.* 8 (12), 1959 (1078–1116). 34 refs. [G.g.russ.e.]

Describes investigations on 3 sandy sites near Frankfurt-an-der-Oder, where Robinia was introduced as an admixture to Pine for site amelioration 20–40 years ago, including one pure Robinia and 3 pure Pine stands. All plots that included Robinia had considerably more soil bacteria and actinomycetes, and fewer soil microfungi, than the pure Pine plots. They also had better and (contrary to the findings of Féher, 1935) more humus, more N, and more moisture in the top layers, but little or no change in pH. The increase in biological activity reached at least to a depth of 40 cm.

### 181.35. Special Modes of Nutrition. Symbiotic Relationships. Parasitism

See also Nos. 2721, 2843, 2848, 3042–3, 3344.

2849. NORRIS, D. O. **Legume bacteriology in the tropics.** *J. Aust. Inst. Agric. Sci.* 25 (3), 1959 (202–7). 29 refs. O.R.E.

A review, including leguminous tree species.

2850. HOLMSGAARD, E. Kvælstofbindingens størrelse hos el: litteraturgennemgang og en undersøgelse af et plantningsforsøg. [**The degree of nitrogen-fixation by Alder: review of literature and an investigation of a planting experiment.**] *Forstl. Forsøgsv. Danm.* 26 (2), 1960 (251–70). 34 refs. [Dan.e.e.]

Reviews some European and American literature (1895–1957) and discusses an experiment begun in Jutland in 1946 in which 4-year-old *Abies alba* were planted at 1·25 × 1·25 m. spacing on old farm land (originally *Calluna* heath) with one plant of either *Pinus banksiana*, *Larix leptolepis*, *Alnus glutinosa*, *Betula* sp. or *Pinus sylvestris* in the same hole so as to protect the Fir from frost and browsing. Observations in 1957 showed that: (1) Fir plants on the Alder plot were darker green and had more needles than on the other plots, but there was no difference in height between Fir plants on Alder, Birch and Pine plots, nor in leader length between those on Alder and Birch plots; (2) the N content in the top 5 cm. of soil, including litter, was 135 kg./ha. higher on the Alder than on the Birch plot, which had the next highest amount; (3) the content of N in needles of Fir on the Alder plot was 1·13% compared with 1·02% on the Birch and Larch plots, where it was next highest.

2851. BOULLARD, B. Importance des mycorrhizes pour la régénération de l'épicéa. [**The importance of mycorrhizae for the regeneration of Norway Spruce.**] *Bull. Soc. For. Franche-Comté* 30 (1), 1960 (1–10). 4 refs. [F.]

A study was made of the root systems of Spruce seedlings from 5 plots, (i)–(v), in forests at 1320–1360 m. alt. and with different soils and site types, and one forest nursery (vi) at 1150 m. alt. on old pasture and given a complete fertilizer 4 years earlier. Soil pH in (i), (ii), (v) and (vi) was 6–6·5, on (iii) and (iv) it was 5·2–5·5. Seedlings were taken up and examined at 20, 50, 60, 80, and 120 days old. Growth on (i) and (ii) was poor, with mycorrhizae absent or developing very late, and many seedlings damped off. On (iii) and (iv) growth was good and mycorrhizae were abundant. On (v), which was a rather more acid soil (pH 6) than (iii) and (iv), mycorrhizae developed later and growth, though satisfactory, was not quite so good. On (vi) growth was good and there were no mycorrhizae, but these plants, when removed from the nursery and planted out in the forest on sites where natural regeneration did badly, generally gave poor results. The seedlings from plot (iii), collected from an old rotten stump, rapidly developed mycorrhizae, though there were none on the rest of the plot. The desirability of leaving old stumps on cut-over land, as a reservoir of mycorrhizal fungi, until replanting, is suggested. Other recommendations are the addition of infected humus to nursery beds, acidification of neutral or feebly acid soils, and sparing use of fertilizers.

2852. **Nitrate and mycorrhizal development.** *Extr.* from *Rep. Dep. For. Qd. 1958/59*, 1959 (21).

A pot experiment was made to test the effect of $NaNO_3$ and $Na_2CO_3$ on mycorrhizal development in *Pinus taeda* in lateritic podzolic soil. Seed was sown in Dec. 1958 in undrained waxed-paper pots and harvested in June 1959. Effects measured were change in soil pH, dry matter of shoots + roots, and % forked short roots (for mycorrhizae). Soil pH was increased by both treatments (7·14–7·17 in treated pots vs. 6·73–6·76 in controls); the effects of $NaNO_3$ and $Na_2CO_3$ were additive. Germination, growth, and mycorrhizal development were poor in the presence of $NaNO_3$. Since $Na_2CO_3$ increased pH but did not depress yield or mycorrhizal development, the effects of $NaNO_3$ could not have been caused by the Na ion but must have been due to the $NO_3$ ion. It is not certain why this should depress growth, but N/P imbalance is suspected. It is an old observation that mycorrhizae are better developed in trees growing in acid than in neutral or alkaline soil. It has been tacitly assumed that this is so because mycorrhizal fungi prefer acid conditions, but the present data show that high soil pH is not necessarily associated with reduced mycorrhizal formation—in this experiment the $NO_3$ ion was the cause. Whether the $NO_3$ ion acts directly or indirectly (e.g. by inhibiting the uptake of P) is not yet known.

2853. BOULLARD, B. À propos des mycorrhizes du *Pinus strobus* L. [**Mycorrhizae of *P. strobus*.**] *Bulletin Trimestriel de la Société Mycologique de France, Paris* 75 (2), 1959 (194–200). 6 refs. [F.] O.B.D.

Presents the results of a survey of mycorrhizae on *P. strobus* (1) in the forests of Épinal, (2) at Saint Amé near Remiremont, and (3) in the Arboretum of Amance near Nancy, with data on frequency of occurrence, types and associations of types. A new subtype *Eb* was found, having all the general characteristics of the known subtype *Ea*, but with a brown sheath. The occurrence of different mycorrhizal types on *P. strobus* in France, Poland and the U.S.A. is discussed [cf. *F.A.* 20 No. 4267].

2854. BAKSHI, B. K., and THAPAR, H. S. **Mycorrhizae in *Taxus baccata* and *Pinus wallichiana*.** *Indian For.* 86 (1), 1960 (16–7 + 4 photos). 3 refs.

The first detailed description of mycorrhizae occurring on *T. baccata* and *P. wallichiana* growing in their natural habitat in the Himalayas (7000–10,000 ft. alt.). The typical form on the Yew is endotrophic and that on the Pine ectotrophic. [Cf. *F.A.* 20 No. 4274.]

2855. LINNEMANN, G. Beobachtungen über die Mykorrhiza-Typen bei *Pseudotsuga*. [**Types of mycorrhizae in Douglas Fir.**] *Allg. Forstzeitschr.* 14 (51), 1959 (882–5). 2 refs. [G.]

Describes research into the relationships of mycorrhizal forms [cf. *F.A.* 17 No. 229] to individual vigour, provenance, and soil. Though not conclusive, experiments point to a connexion between vigour (whether innate or due to suitable environment) and a 'fine' type, and poor growth and a feathery type of mycorrhiza. Mycorrhizae formed even in some sterilized soils (though less and later there than in others), leafmould being the most unfavourable substrate.

2856. LINNEMANN, G. Rassenunterschiede bei *Pseudotsuga taxifolia* hinsichtlich der Mycorrhiza. [**Racial differences in *P. taxifolia* as regards mycorrhiza.**] *Allg. Forst- u. Jagdztg.* 131 (2), 1960 (41–7). 4 refs. [G.g.]

Investigations on trees aged 30–60 from 7 trial series on different soils, and on 2-year-old seedlings, indicated that in general the variety *glauca* had fewest mycorrhizae and *viridis* the most, with *caesia* intermediate. [Cf. preceding abstract.]

## 181.36. Root Relations and Root Development etc.

See also Nos. 3085–6, 3107, 3168, 3365.

2857. JEFFREY, W. W. **White Spruce rooting modifications on the fluvial deposits of the lower Peace River.** *For. Chron.* 35 (4), 1959 (304–11). 11 refs.

During ecological reconnaissance on the lower Peace River fluvial deposits in Northern Alberta, striking modifications of the normal rooting system of White Spruce were noted to be relatively abundant. Two main forms: (*a*) a heavily buttressed variant, and (*b*) a multi-layered variant, are illustrated. Periodic inundation and siltation probably result in the stimulation of buried portions of the stem to produce adventitious roots. The multi-layered root type provides a high degree of resistance to windthrow. *Author's summary.*

2858. MERRITT, C. **Studies in the root growth of Red Pine (*Pinus resinosa* Ait.).** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (5), 1959 (1513–4). O.R.S.

Observations were made on root elongation and number of roots active in 2-year seedlings growing in glass-sided boxes at 70° F., with a 16-hr. photoperiod, and root systems were found to possess a pattern of growth conforming closely to the usual seasonal changes in natural environments. Tests on the nature of this pattern were made, with seedlings grown in soil or solution, in greenhouses or in chambers with controlled temperature and photoperiod and, for one group of seedlings, soil moisture. The basic pattern of root growth proved to be inherently controlled, but environmental variations produced quantitative changes in root growth and influenced the timing of events; e.g. increases in temperature from 60° to 80° F. decreased the time elapsing between the beginning of growth and its period of greatest activity, and resulted in quantitative reductions in total growth. Analysis of growth activity showed evidence of short-term cycles, varying as a rule from 12 to 4 days, in new-root initiation and in root elongation. Individual roots within a root system showed wide variations in growth rate, and times of growth initiation and cessation of elongation were also very variable; as a result, dormant roots were found at all times during the study. Clipping needles to varying lengths showed that spring root growth was proportional to the amount of needle tissue left intact. Removal of the terminal bud had little effect. Root growth showed a close relation to the average 24-hr. temperature, while shoot growth was more nearly correlated with dark-period temperatures.

2859. JENÍK, J. Beitrag zur Kenntnis der Heterorrhizie dikotyler Holzpflanzen. **[Heterorrhizy [the occurrence of morphologically and anatomically different types of rootlet] on dicotyledonous woody species.]** *Phyton, Horn* 8 (1/2), 1959 (1–9). 12 refs. [G.g.] L.S.

Discusses function, anatomy, and morphology of two types of rootlet, viz. (*a*) 'thickened' and (*b*) 'of limited growth', with special reference to *Quercus robur* s.l. Rootlets of type (*a*) are most clearly developed in the lower, moist horizons of the *Querceto-Ulmetum*, where they are frequently blue-black in colour owing to the formation of compounds between tannins and the Fe of the soil. Those of type (*b*) are always far more abundant; in Oak they are thinner and shorter, and most of them are transformed into mycorrhizae. Differences between the two types are tabulated, and it is stressed that (*b*) cannot be regarded as deformed variants or modifications of (*a*). Type (*a*) appears to be adapted to active extension of the rhizosphere, having a considerable capacity for growth in length; (*b*) are primarily organs of organo-mineral (mixotrophic) nutrition, mostly dying after a few years. [Cf. *F.A.* 20 No. 258.]

### 181.4. Reaction to Biotic Influences (Competition etc.) and Fire

See also Nos. 2827, 2917, 3402.

2860. KNAPP, R. Über die gegenseitige Beeinflussung von Pflanzenarten in Trockenrasen und Laubwäldern. **[The interaction of plant species in dry grassland and deciduous forest.]** *Ber. Dtsch. Bot. Ges.* 62 (9), 1959 (368–82). 20 refs. [G.g.] O.B.D.

Discusses, and illustrates by examples from these two types of plant community, the innate ability of different plant species to exercise an inhibiting influence on the growth of others independent of the site. The inhibition of growth of hardwood seedlings by grasses is one of the aspects dealt with.

2861. LITTLE, S., and SOMES, H. A. **Sprouting of Loblolly Pine.** *J. For.* 58 (3), 1960 (195–7). 7 refs.

Trials in Maryland on samples of 6–20 of every age up to 10 years showed that *Pinus taeda* seedlings may sprout after severance of the stem. Most sprouts start from dwarf-shoot sites: from buds or meristems formed in the axils of primary needles, from needle fascicles, or from minute branches originating in these axillary sites. However, nodal buds also probably produce sprouts occasionally. Sprouting can therefore occur only if a portion of bud-bearing epicotyl remains after the cut. *P. taeda* does not sprout after fire because the buds are all situated above ground and thus easily killed. Sprouting vigour declines with increased seedling age over 2 years, and most sprouts that arise on 3-year and older seedlings die off. [Cf. *F.A.* 16 No. 234; 17 No. 3719.] *From authors' summary.*

2862. ANDRESEN, J. W. **A study of pseudo-nanism in *Pinus rigida* Mill.** *Ecol. Monogr.* 29 (4), 1959 (309–32). 96 refs.

Several areas in the Pine region of S. New Jersey, called 'The Plains', support low-coppice forest of *Pinus rigida*, *Quercus ilicifolia* and *Q. marilandica* averaging 4–6 ft. in height. Opinion differs as to whether repeated fires or high concentrations of soluble Al in the soil are the primary cause of this condition, and the present study was initiated to determine whether Al plays a significant role in the growth form of Pines in the Plains, Barrens, and transitional communities. Results indicated that, in natural soil, Al is not lethal, even in very high concentrations, that it has no apparent influence in depressing growth, and that it is not contributing to the maintenance of existing nanism. *P. rigida* is classed as an Al-accumulator. It is concluded that fire has been the principal factor in the creation and maintenance of the stunted *P. rigida* and other species in the Plains area. The ability of *P. rigida* to coppice from dormant buds round the root collar after top-killing by fire is discussed.

2863. BIANCO, P. Cambiamenti della vegetazione dopo un incendio della macchia La Forgia. **[Changes in vegetation after fire in the maquis of La Forgia.]** *Nuovo G. bot. ital.* (*n.s.*) 65 (1/2), 1958 (388–94). 5 refs. [It.] A.P.B.

*Quercus trojana* proved well able to regenerate itself by coppice regrowth after severe burning.

### 181.5. Reproductive Behaviour

See also Nos. 2739, 2753, 2755–6, 2771, 2830–2, 2861, 2952 *et seq.*, 3004 *et seq.*

2864. FEINBRUN, N., RAHAT, A., and TAS, J. **Further studies in atmospheric pollen in Jerusalem.**

*Bull. Res. Coun. Israel* 8*D* (1), 1959 (31–40 + 2 gphs.). 7 refs.

A report on airborne pollen from Oct. 1955 to Oct. 1956. Results were similar to those previously reported [cf. *F.A.* 19 No. 1496].

2865. JUNACK, H. Der Einfluss von Bestandesalter und Bestandesstellung auf die Befruchtung der Douglas-Blüte. **[The influence of stand age and formation on the fertilization of Douglas Fir flowers.]** *Forst- u. Holzw.* 15 (5), 1960 (95–6). 4 refs. [G.]

Presents and discusses data on the 1958 Douglas Fir cone harvest in the Gartow district, on (1) 80-year-old emergents in a closed stand, (2) isolated trees, 50 and 80 years old, (3) 50-year-old trees with lateral protection, and (4) 35-year-old trees under light Pine shelter. It is concluded that the best conditions for fertilization are with lateral protection or overhead shelter, and that Douglas can produce full, viable seed at the age of 35 years.

2866. **[Study of the seed production of *Pinus armandii* in Yunnan province.]** *For. Sci., Peking* 1958 (4), (435–50). 14 refs. [Chin.]

The area, in Imen district, is described in some detail. The Pine predominates in mixed forest (1500–3000 m. alt.) with *Alnus nepalensis*, the commonest associate, and *Cinnamomum glanduliferum*, *Quercus dentata*, *Juglans regia*, etc. [13 main-canopy and 31 lower-storey and ground-cover species listed, with scientific names]. In all, 1223 Pine were studied on some 12,500 sq. m. of forest, and tables give their age, d.b.h., height, and distribuion, viz. 223–1746 per 100 mu [ca. 15·2 acres], their site characteristics and cone size, weight and seed yields, for each area of study. The tree in this region flowers and seeds after the 14th year and up to even 80 years. The seed ripens from mid-September to the end of October. In two areas, cone yields averaged 2624 and 2769 kg./100 mu of mixed forest. The Pine grows better on shady sites but its seed production is reduced, as also on drier, hotter sites. The worst pest is the moth *Dioryctria abietella* which may practically destroy a seed crop, the larvae boring into and eating the cone scales.

2867. SARFATTI, G. Differenziazione pre-invernale delle pine ♀ in *Pinus silvestris* L. **[Prehivernal differentiation of the ♀ cones in *P. sylvestris*.]** *Nuovo G. bot. ital* (*n.s.*) 45 (1/2), 1958 (370). [It.it.e.] A.P.B.

A small ♀ cone of *P. sylvestris* was found on material collected in Oct. 1955. Differentiation of ♀ cones in late summer or autumn is also recorded for several other *Pinus* spp.—*P. mugo* var. *pumilio*, *P. nigra* and *P. halepensis*.

2868. CORTI, R. Osservazioni sul ciclo riproduttivo di *Quercus coccifera* L. presso le Meteore (Grecia). **[Observations on the reproductive cycle of *Q. coccifera* near Meteora, Greece.]** *Nuovo G. bot. ital.* (*n.s.*) 65 (4), 1958 (1959), (823–6). 4 refs. [It.it.e.] A.P.B.

Biological studies confirmed the deduction from anatomical studies that the Greek, like the Apulian and Algerian, race of *Q. coccifera*, is not to be regarded as distinct from the type.

2869. CORTI, R. Appunti sul ciclo riproduttivo di *Quercus pedunculata* Ehrh. nella Selva Pisana. **[Notes on the reproductive cycle of *Q. robur* in the forest of Pisa.]** *Nuovo G. bot. ital.* (*n.s.*) 65 (4), 1958 (1959), (826–8). 2 refs. [It.it.e.] A.P.B.

The reproductive cycle of Pedunculate Oak at Pisa was found to be the same as that in southern Sweden, but chronologically earlier, e.g. fertilization takes place 45 days earlier than in Sweden.

2870. KOBAYASHI, Y., and MIDORIKAWA, T. **[Dendrological studies of the Japanese Fagaceae—on the ripening term of the fruits of *Quercus*, *Castanopsis* and *Pasania*.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 117, 1959 (11–42 + 13 plates). 29 refs. [Jap.e.*e*.]

Gives details (with photographs) of those species that fruit annually and those that fruit biennially.

2871. LONGMAN, K. A., and WAREING, P. F. **Early induction of flowering in Birch seedlings.** *Nature, Lond.* 184 (4704), 1959 (2037–8).

An experimental attempt to shorten the juvenile period in *Betula verrucosa* was begun in 1957. It was designed to determine whether the tree develops the capacity for reproduction as a result of attaining a certain height or size, or as a result of undergoing a certain number of cycles of growth and dormancy. The two treatments applied were: (1) Continuous growth under long-day or continuous illumination in a greenhouse at ca. 15–25° C. (2) Periodic growth, in which the trees first made ca. 30 cm. of extension growth under the above conditions, and then had their growth stopped by short-day treatment (9 hr.); after 6 weeks' chilling at 0–5° C. they were returned to long-day illumination. Seed was sown in Feb. 1957. During the period Nov. 1957—Feb. 1958, when they were 1·9–2·7 m. high and $<$ 1 year old, 7 of the 14 trees under treatment (1) initiated catkins within buds of the upper part of the stem, as many as 75 being found on one tree. The control plants and those given treatment (2) have still (Sept. 1959) produced no catkins. It is clear, therefore, that growing Birch continuously for 10–12 months may stimulate flower initiation at a very early age. Scions from flowering branches of (1) were bottle-grafted on to seedling rootstocks in Aug. 1958 and one of these has already initiated 3 catkins, thus providing evidence that this tree, at least, had undergone a foreshortened but permanent process of maturation.

2872. **Seed dispersal in the Western Larch-Douglas Fir type.** *Extr.* from *Rep. Intermt. For. Range Exp. Sta. 1958*, 1959 (5–6).

A six-year study in over-mature stands largely confirmed original findings [cf. *F.A.* 15 No. 2340]. Virtually no seed was dispersed beyond 4 chains except in good seed-years. Seed production trends were similar for both species, with soundness % increasing with abundance. Though prevailing winds were not in this direction, more seed was dispersed uphill than in any other direction, presumably under the influence of 'dry thermal winds' opening the cones.

2873. MOWAT, E. L. **No serotinous cones on central Oregon Lodgepole Pines.** *J. For.* 58 (2), 1960 (118–9). 5 refs.

In sampling over 13 areas at 4300–6400 ft. alt. in central Oregon, cone-bearing branches of *Pinus contorta* were collected from different parts and aspects of mature and young trees. No viable seeds were found in cones older than those of the current year. Cones remained on some trees up to 25 years, and retained their ability to open and close with successive wet and dry periods for ca. 8–10 years. [Cf. *F.A.* 19 No. 1413.]

2874. SELIK, M., and BODO, G. Untersuchungen über den Eiweissabbau in den Samen der auf dem Baum bleibenden Zapfen von *Pinus halepensis* Mill. **[Breakdown of proteins in seeds of unfallen *P. halepensis* cones.]** *Planta* 54 (4), 1960 (404–8). 4 refs. [G.g.] O.B.D.

A breakdown of proteins was shown to have taken place in seeds that had remained in closed cones on the tree. These seeds exhibited pathological symptoms but were found along with normal seeds in the same cone. They had a not quite normal, or poorly developed, embryo, or none at all. Free amino-acids arising from the protein breakdown increased in number and quantity with the age of the seed.

2875. LITTLE, S., and SOMES, H. A. **Viability of Loblolly Pine seed stored in the forest floor.** *J. For.* 57 (11), 1959 (848–9). 6 refs.

In early March, 1957, ca. 100 sound seeds from the 1956 crop were placed on each of 50 selected spots from which the litter had been removed. The seeds were protected by wire mesh and the litter carefully replaced. The germination of seed from some of these spots was determined in late April, 1957, and in May and July, 1958. Results indicated that very few seeds of *Pinus taeda* remain viable in the forest floor through the second winter after they mature.

2876. FISCHER, F., SCHMID, P., and HUGHES, B. R. Anzahl und Verteilung der in der Schneedecke angesammelten Fichtensamen. **[The number and distribution of Spruce seeds embedded in the snow cover.]** *Mitt. Schweiz. Anst. Forstl. Versuchsw.* 35 (7), 1959 (459–79 + 2 plates). 6 refs. [G.g.f.e.it.]

A count of seed was made along contour lines from ca. 1850 to 2100 m. near Davos in April 1959, after an exceptionally good seed-year. There was a steady decrease in an exponential curve, from 1–3 million seeds/ha. at 1850–1900 m. in subalpine Spruce forest, to 20–250 seeds at 2050–2100 m. alt., i.e. above the forest but below the tree line. This is only partly explained by the reduction in Spruce, of which many individuals were found in the Larch/*Pinus cembra* forest up to ca. 2050 m. and some even higher. The need for further investigation is stressed.

2877. ZENTSCH, W. Zur Wasseraufnahme keimender Koniferensamen. **[Uptake of water by germinating conifer seeds.]** *Naturwissenschaften* 47 (3), 1960 (70). 2 refs. [G.] O.R.S.

Seeds of *Picea abies*, *Pinus sylvestris*, *P. nigra* and *Larix decidua* were placed with (*a*) the part of the seed containing the cotyledons, or (*b*) that containing the radicle, downwards in sand saturated with water. Germination was better for (*a*) than for (*b*), significantly so for Spruce and Larch but not for the Pines. Further study is planned on Spruce, in which the difference betwen (*a*) and (*b*) was greatest.

2878. JUDIN, V. G. Zavisimost′ glubiny pokoja semjan nekotoryh vidov klena (*Acer* L.) ot stepeni ih zrelosti. **[The degree of dormancy in ripe and unripe seeds of some *Acer* species.]** *Bot. Ž.* 44 (12), 1959 (1748–53). 17 refs. [Russ.]

[Cf. *F.A.* 19 No. 3836; 21 No. 265.] Samples of seeds of *A. platanoides*, *A. pseudoplatanus*, *A. tataricum* and *A. ginnala* growing at Leningrad were taken every 7 days from the second half of July until mid-October. The seeds were germinated at 0–10° C. and 15–20°, and isolated embryos were also germinated at 15–20°, in Petri dishes. There were two replications, with 30 seeds in each. Results are tabulated and graphed. None of the seeds of any species was able to germinate at 15–20°, irrespective of the stage of ripeness. Isolated embryos of all four species were able to grow at 15–20°, the rate of germination and time taken to germinate varying with species and stage of ripeness; only *A. ginnala* grew normally, however. Seeds of *A. platanoides*, *A. tataricum* and *A. pseudoplatanus* have a period of dormancy—both ripe and unripe seeds require reduced temperatures, but ripe seeds require them for a shorter period. In further experiments, dry storage of *A. platanoides* and *A. tataricum* seeds of various stages of ripeness did not affect their degree of dormancy, but ripe seeds reacted more quickly than unripe ones to reduced temperatures.

2879. VILLIERS, T. A., and WAREING, P. F. **Interaction of growth inhibitor and a natural germination stimulator in the dormancy of *Fraxinus excelsior* L.** *Nature, Lond.* 185 (4706), 1960 (112–4). 5 refs.

A study of germination in various conditions, in chilled and unchilled seeds and excised embryos, suggests that the deep dormancy of *F. excelsior* seed is imposed by the presence of growth inhibitors in both endosperm and embryo. During chilling, this dormancy is overcome by the production of a germination-stimulating substance in the tissues of the embryo.

2880. VELKOV, D. Biologičeski osobenosti na žăládite na červenija dăb i ‘novite’ prinosi po tozi văpros. **[New data on the biological characteristics of acorns of [American] Red Oak.]** *Gorsko Stopanstvo* 15 (5), 1959 (24–9). [Bulg.]

To supplement other work [see *F.A.* 21 No. 270], data are tabulated on the resistance of (*a*) ungerminated, (*b*) pre-germinated, and (*c*) growing acorns to temperatures of − 10 and −8° C. for periods up to 14 days. The reasons for the much poorer showing of (*b*) and complete failure of (*c*) are discussed, and the amounts of bound and free water in the acorns of several species of Oak are compared. The relative advantages of autumn and spring sowing of Red Oak in Bulgaria are discussed.

2881. HOSNER, J. F. **Survival, root and shoot growth of six bottomland tree species following flooding.** *J. For.* 57 (12), 1959 (927–8). 5 refs.

Seedlings of 6 species were placed for 38 days in saturated soil and then transferred for 60 days to well drained soil. Observations of their ability to withstand and recover from such conditions gave the following ranking: (1) *Populus deltoides*; (2) *Fraxinus pennsylvanica*; (3) *Platanus occidentalis*; (4) *Quercus palustris*; (5) *Quercus falcata*; (6) *Celtis occidentalis*. [Cf. *F.A.* 20 Nos. 273–4; 21 No. 2959.]

### 181.6. Life Form, Habit. Post-Seedling Development and Form

See also Nos. 2765, 2767, 2833–4, 2842, 2862, 2917 2949.

2882. OKSBJERG, E. B. Om miljöns inflytande på skogssträds växtrytm. **[The effect of the environment on the growth rhythm of trees [with comments by H. Johnsson].]** *Norrlands SkogsvFörb. Tidskr.* 1959 (4), (353–80). 45 refs. [Sw.e.]

Describes, with illustrations, the growth of Pines invading heathland in Halland. The solitary pioneer trees, exposed to the sun and with ample space, are of poor form and, after the initial stages, of very slow height growth, whereas trees coming in later from the same seed sources and growing in groups have narrow crowns and rapid height growth as a result of close spacing and shading, and soon overtop the pioneers. Pioneers that are surrounded at a fairly early age (20–35 years) by dense regeneration may, however, respond by new, more rapid height growth. Literature (mainly Scandinavian and German) on thinning Pine, Spruce, and Beech is discussed in connexion with the relations of growth in the juvenile, vegetative, and reproductive stages of development, to space and insolation. Examples are given of differences in crown form, and cone size and abundance, in trees of the same chronological age but representing the vegetative or reproductive stages respectively. Concludes that, in the present stage of knowledge, environment appears to be a more important factor than inherited properties, and stresses the difficulties of selecting plus trees. Johnsson in his comment makes the distinction between plus and élite trees, ignored by Oksbjerg, and discusses its effect on his argument.

### 181.7. Duration, Longevity, Stature; Records of Exceptional Age or Size. Effects of Age on Behaviour

2883. WOHLFARTH, E. 400jährige Kiefern im Hochschwarzwald. **[Four-hundred-year-old Pines in the High Schwarzwald.]** *Holz-Zbl.* 86 (10), 1960 (103–4). 1 ref. [G.]

Trees aged ⩾ 400 years, found in an uneven-aged stand of Pine and Spruce on a plateau at 940 m. alt., suggest that Pines may be the oldest forest trees of the Black Forest and native to the region. The stems, 25–30 m. high and 50–60 cm. in d.b.h., have been slow-growing throughout, though at varying rates, with more recent mean ring-widths of 0·3–0·5 mm. They were perfectly sound, with a narrow (3–5 cm.) sapwood zone.

2884. PANARETOS, A. **Some gigantic trees of Cyprus.** *Countryman, Nicosia* Jan., 1960 (14–6).

Notes on 10 exceptionally large and old trees (Olive, 2 Oaks, Plane, Carob, Bitter Orange, Pine, Sycamore Fig, and *Pistacia atlantica*).

2885. VASIL′ČENKO, I. T. O razvitii derev′ev i kustarnikov u verhnej granicy ih rasprostranenija v gorah Srednej Azii. **[The development of trees and shrubs at the timberline in the mountains of Central Asia.]** *Bot. Ž.* 44 (12), 1959 (1717–20). 11 refs. [Russ.]

Describes certain small areas ('micro-regions') in the mountains, where trees attain very large sizes. These areas are not, as would be usual, in the middle of the altitudinal range of the species, but at the timberline, next to the unforested subalpine belt. Examples of such unusual stature in *Juniperus seravschanica*, *Juglans regia*, *Lonicera persica*, etc. are described. Study of these areas could be important for mountain afforestation.

### 181.8. Phenology

See also Nos. 2738, 2745, 2747, 2765, 2838, 2858, 2867–71, 2995, 3047, 3663.

2886. HUTAMURA, S., and IHARA, N. **Seasonal rhythms of plant life in the evergreen broadleaved forests of the laurel-leaved and sclerophyllous types in S.W. Japan.** *Japanese Journal of Ecology* 9 (4), 1959 (154–9). [Jap.g.e.] From *abstr.* in *Biol. Abstr.* 35 (6), 1960 (No. 14878).

Seasonal rhythms of plant life in the *Shiia* and *Quercus phillyraeoides* type forests were studied by monthly measurement of the osmotic value of dominant and characteristic species. The annual maximum value of osmotic pressure of *Q. phillyraeoides* is ca. 8 atm. higher than that of *Shiia*. The curves of osmotic value of plants in the herb layer showed lower values than the forest trees; but in the cold period of winter the fern *Dryopteris erythrosora* showed much higher values.

### 181.9. Miscellaneous (Including the Ecological Role after Death of Plants or Parts of Plants)

See also No. 2956.

2887. JAHN, E., and SINREICH, A. Befallsfolgen von Gliederfüsslern in absterbenden Zirben (*Pinus cembra* L.). **[Succession of attack by arthropods in dying and dead *P. cembra*.]** *Anz. Schädlingsk.* 33 (2), 1960 (17–20). 8 refs. [G.]

The succession was followed of the arthropod fauna inhabiting decayed wood in felled and windthrown trees on Alpine sites. [Cf. *F.A.* 21 No. 1854.]

## 182. Synecology, Plant Sociology: General, Principles and Methods

### 182.1. Palaeoecology. History of Vegetation. Pollen Analysis

See also No. 2641.

2888. DURNO, S. E. **Occurrence of pollen of *Fraxinus* in northern Scottish peats.** *Trans. Bot. Soc. Edinb.* 37, 1956/1959 (220–2). 5 refs. O.B.D.

Pollen of *Fraxinus excelsior* has been identified from 8 Scottish peat deposits, all north of latitude 57° N. The occurrence is almost entirely post-Boreal, reaching a maximum in the sub-Boreal. The author suggests that these identifications, although small, may throw light on the question whether *F. excelsior* is native to Scotland or not.

2889. Paganelli, A. Cicli forestali postglaciali del piano montano dell' Appennino Umbro-Marchigiano attraverso l'analisi pollinica del deposito lacustre del 'Pantani' (1589 m.). **[Postglacial forest succession on the high plateau of the Umbrian Apennines revealed by pollen analysis of the lacustrine deposits at 1589 m. alt.]** *Nuovo G. bot. ital.* (*n.s.*) 45 (1/2), 1958 (202–13). 38 refs. [It.it.e.] A.P.B.

Traces the principal phases (*Pinus-Salix-Quercetum mixtum* and *Quercetum mixtum*) that characterized the continental anathermic period, and the *Fageto-Abietum* phase of the oceanic catathermic period.

2890. Chiarugi, A. Ricerche sulla vegetazione dell' Etruria. XI. Una seconda area relitta di vegetazione spontanea di pigella (*Picea excelsa* Lk.) sull' Appennino settentrionale. **[Studies on the vegetation of Etruria. XI. A second relict area of *Picea abies* in the N. Apennines.]** *Nuovo G. bot. ital.* (*n.s.*) 45 (1/2), 1958 (23–42 + 4 photos). 18 refs. [It.it.e.] A.P.B.

An earlier example was recorded in 1936. Pollen analyses of peats in the neighbourhood of the stand now described confirm that it is indigenous.

2891. Dinesman, L. G. K istorii drevesno-kustarnikovoj rastitel′nosti meždurec′ja Urali i Volgi. **[The history of the tree and shrub vegetation of the region between the Volga and Ural rivers.]** *Trud. Inst. Les.* No. 38, 1958 (171–81 + 1 plate). 32 refs. [Russ.]

Forest vegetation existed till the mid-19th century along river banks, round lakes, and in depressions in the N.W. of the Cis-Caspian lowland, but was then destroyed by primitive pastoral husbandry. Forest never existed on the soils of the solonetz complex, and to afforest them will require the creation of completely new biogeocoenoses. Species with a vertical root system able to tap the groundwater should be chosen.

2892. Hussey, A. M., II. **Age of intertidal tree stumps at Wells Beach and Kerreburk, Maine.** *Journal of Sedimentary Petrology, Tulsa, Okla.* 29 (3), 1959 (464–5). From *abstr.* in *Biol. Abstr.* 35 (5), 1960 (No. 14112).

Radiocarbon dates on two samples from each locality range from 2810 to 3250 ± 200 years.

### 182.2. Succession, Alternation and Periodicity in Vegetation

See also No. 3402.

2893. Nicholls, J. L. **The volcanic eruptions of Mt. Tarawera and Lake Rotomahona and effects on surrounding forests.** *N.Z. J. For.* 8 (1), 1959 (133–42). 16 refs.

Reviews all the published information on the effect on vegetation of the showers of volcanic ash erupted about 70 years ago. It is concluded that severe damage was very limited in extent and recovery is now far advanced, with new associations destined scarcely to differ from the old.

2894. Percy, C. A. **A primary survey of the vegetation of Marotiri Island.** *Tane* No. 7, 1955/1956 (1957), (3–6). From *abstr.* in *Biol. Abstr.* 35 (5) 1960 (No. 12412).

The island was apparently cleared during the long Maori occupation, and the existing vegetation is relatively young, with an absence of very large trees. The probable trends of succession are discussed, including the influence of chance arrivals, and of sea winds.

2895. Buell, M. F., and Facey, V. **Forest-prairie transition west of Itasca Park, Minnesota.** *Bull. Torrey Bot. Cl.* 87 (1), 1960 (46–58). 6 refs. O.B.D.

Presents the results of a study of the vegetation in this region, where the transition from forest to prairie is very abrupt, and of its relationship to topography, soil conditions and the recent history of cultivation. Woodland increased and prairie decreased over the last 50 years; changes in uncultivated areas are largely the result of decreased fire incidence and drainage of wet soils.

### 182.3. Units of Vegetation (Associations etc.: Theory)

See No. 2901.

### 182.4. Layer Communities

See also No. 2847.

2896. Tagawa, H. **Evaporation as an environmental factor for the epiphytic mosses in Beech forests.** *Japanese Journal of Ecology* 9 (5), 1959 (178–84). [Jap.jap.] From *abstr.* in *Biol. Abstr.* 35 (6), 1960 (No. 14885).

2897. Fedorov, A. A. Drevesnye ėpifity i fikusy-udušiteli v tropičeskih lesah Kitaja. **[Woody epiphytes and strangler Figs in the tropical [rain] forests of China.]** *Bot. Ž.* 44 (10), 1959 (1409–24 + 4 plates). 21 refs. [Russ.e.]

On the basis of his own studies and those of Richards [cf. *F.A.* 20 No. 1620], and following in part the terminology of Corner [cf. *F.A.* 2 p. 261], the author distinguishes six main types of 'radical trunk' in *Ficus* spp. that have become independent trees after killing their hosts: (1) reticulate ('meshy') basket sheath; (2) continuous ('solid-wall') basket sheath; (3) longitudinally ribbed sheath; (4) banyan; (5) tripod; and (6) ladder type. The characteristics of each type are described. In S. Yunnan and Hainan, 25 species of epiphytic root-climbing and strangling Figs (listed) have so far been recorded. The part played by the stranglers in the forest ecosystem, the evolution of the genus *Ficus*, and the relation of the phylogeny of the genus to the history of the tropical rain forests are discussed.

### 182.5. Synecological Measurements and Methods

See also Nos. 2920, 3542.

2898. Dansereau, P., and Arros, J. Essais d'application de la dimension structurale en phytosociologie. 1. Quelques exemples européens. **[The application to plant sociology of the system of classification on a structural basis. 1. Some European examples.]** *Vegetatio* 9 (1/2), 1959 (48–99). 27 refs. [F.] A.P.B.

Applies the system of diagrammatic representation already described [see *F.A.* 20 No. 1602] to descriptions of 83 European associations, by 17 authors, published during 1954.

2899. Yli-Vakkuri, P. **A method for establishing small permanent sample plots for ecological studies.** *Acta for. fenn.* 68 (3), 1958 (1959). pp. 7. 5 refs. [E.fi.*fi.*]

Central points of sample plots were marked by small iron stakes $\frac{5}{16}$ in. in diameter and 60 cm. long, with number plates if desired. Counts were made by centring a portable circular frame of a given area (0·25 sq. m. being found suitable) on the rods via an aperture at the centre of a diametrical strut. For each series of observations 10–20 plots were used, with marking stakes randomly placed 2–3 m. apart.

### 187. Vegetation Types

See also Nos. 2623, 2626, 2634, 2685, 2746, 2886, 2894, 2897, 2962, 2973, 3119, 3124, 3127, 3179, 3402, 3556, 3895, 3900–1, 3917, 3923, 3928.

2900. Keltikangas, V. Suomalaisista seinäsammattyypeistä ja niiden asemasta Cajanderin luokitusjärjestelmässä. **[Finnish feather-moss types and their position in Cajander's forest site classification.]** *Acta for. fenn.* 69 (2), 1959. pp. 266. 164 refs. [Fi.e.*e.*]

Reviews the development and essential features of Cajander's system of forest site types, and discusses some of the criticisms that have been made against it, and the difficulties that have arisen in its use, particularly with respect to the permanency of site types, the reversibility of changes in vegetation, and the influence of the vegetation itself on the productivity of the site. These are illustrated by reference to the *Hylocomium-Myrtillus* type, which some ecologists believe to be the product not of the 'primary' site factors, but solely of the Spruce with its concomitant raw humus etc. The opinions of Aaltonen, Tamm, Siren and others on this subject are outlined and discussed. The author concludes that the facts substantiate the correctness of Cajander's concepts, criticism of which has been largely due to misunderstanding. [Cf. *F.A.* 15 No. 3384; 16 No. 760; 17 No. 1387.]

2901. Scamoni, A., and Passarge, H. Gedanken zu einer natürlichen Ordnung der Waldgesellschaften. **[Suggestions for a natural classification of forest plant communities.]** *Arch. Forstw.* 8 (5), 1959 (386–426). 70 refs. [G.g.russ.e.]

Proposes and works out in detail a revised system of forest plant communities for the region of the N.E. German plain, based on a modification of the Braun-Blanquet system, in which the main classification principle rests on sociological characteristics—grouping of species, average number of species, their frequency, etc.—rather than on character species. *From authors' summary.*

2902. Schlüter, H. Relative Standortskonstanz bei Waldgesellschaften in verschiedenen Höhenstufen des nordwestlichen Thüringer Waldes. **[Relative site constancy in forest communities at different altitudinal levels of the north-western Thüringer Wald.]** *Ber. Dtsch. Bot. Ges.* 72 (8), 1959 (349–54). 13 refs. [G.g.] O.B.D.

Walter formulated in 1954 the 'law of relative site constancy' as follows: 'If, within the habitat of a species, the climate changes in any particular way, a change of biotope takes place, by which the effects of the climatic change on the species are avoided so that, from the point of view of temperature and moisture, the site of any one species within its area of growth remains relatively constant.' In this article, his law is applied to forest communities of the Thüringer Wald that range over several altitudinal zones. The best example is offered by the *Luzula/Quercus sessiliflora/Fagus sylvatica* forest, which in the Oak/Beech zones is to a large extent independent of aspect, but in the higher Beech zones occurs only on S. to W. slopes, the characteristic species composition remaining unchanged. A brief review is also made of the applicability of the law to differences in plant communities when compared in the horizontal and vertical directions and also to differences in zonal, extrazonal and azonal communities.

2903. Schlüter, H. Waldgesellschaften und Wuchsbezirksgliederung im Grenzbereich der Eichen-Buchen- zur Buchenstufe am Nordwestabfall des Thüringer Waldes. **[Forest plant communities and delimitation of growth-regions in the transition zone from the Oak/Beech to the Beech zone on the N.W. slope of the Thüringer Wald.]** *Arch. Forstw.* 8 (5), 1959 (427–93). 85 refs. [G.g.russ.e.]

A plant-sociological investigation with special regard to altitudinal zones and the effect of aspect and edaphic conditions. Four sub-growth-regions are delimited, corresponding as far as possible to the zones Oak/Beech, transitional, lower Beech and upper Beech. The most important associations are the *Luzulo-Fagetum* and the *Melampyro-Fagetum*. [Cf. *F.A.* 19 No. 3976.]

2904. Doing Kraft, H., and Westhoff, V. De plaats van de beuk (*Fagus sylvatica*) in het midden- en west-europese bos. **[The place of *F. sylvatica* in the forests of Central and Western Europe.]** *Jaarb. Ned. Dendrol. Ver.* No. 21, 1956–1958 (1959), (226–54). 81 refs. [Du.g.e.]

On the basis of a study of the literature and of field work in natural woodland in different countries, a vegetation system is proposed in which *Fagetalia* is divided into the sub-orders *Acereto-Fagetalia* of the mountain belt and *Querceto-Fagetalia* of the lowlands, and the latter into the alliances *Carpinion* and *Querceto-Fagion*.

2905. Maas, F. M. Bronnen, bronbeken en bronbossen van Nederland, in het bijzonder die van de Veluwezoom: een plantensociologische en oecologische studie. **[Springs, streams, and woods in the neighbourhood of springs, especially those on the borders of the Veluwe: a phytosociological and ecological study.]** *Repr.* from *Meded. LandbHogesch. Wageningen* 59 (12), 1959 (1–166 + 19 tbls.). 200 refs. [Du.f.e.]

The woodland communities are grouped into the alliances *Alno-Ulmion* (including the sub-alliance *Alnion incanae*) and *Alnion glutinosae* (sub-alliances *Irido-Alnion* and *Sphagno-Alnion*).

2906. SAMEK, V. Przyczynek do typologicznej klasyfikacji lasu tatrzańskiego. **[Typological classification of the Tatra forests.]** *Sylwan* 103 (12), 1959 (7–16 + 1 tbl.). 44 refs. [Pol.russ.g.]

Presents a tabular classification with brief descriptions of the types.

2907. IZDEBSKA, M. Badania fitosocjologiczne w lasach leśnictwa Zemborzyce. **[Phytosociological investigations in stands in the Zemborzyce forest district.]** *Ann. Univ. M. Curie-Skłodowska, Lublin* 13*C* (9), 1958 (1959), (143–63 + 1 tbl.). 20 refs. [Pol.russ.g.*russ.g.*] C.G.B.

Distinguishes and describes the following associations: *Querceto-Potentilletum albae* (with two variants), *Pineto-Quercetum*, and *Pineto-Vaccinietum myrtilli*.

2908. GOLGOFSKAJA, K. JU. Tipy bajračnyh lesov rajona Derkul'skoj naučno-issledovatel'skoj stancii po polezaščitnomu lesorazvedeniju. **[Natural forest types at the S. limit of forest in the [steppe] region of the Derkul Experiment Station for Shelterbelt Forestry.]** *Trud. Inst. Les.* No. 34, 1958 (5–82). 111 refs. [Russ.]

An account of conditions in the area (extreme E. of the Ukraine), features of the vegetation, human influences, and the forest types (Ash/Oak, Elm/Lime, and groups of Oak), together with recommendations on management.

2909. L'VOV, P. L. Fragmenty sosnovogo redkoles'ja v suhih predgor'jah Dagestana. **[Fragments of *Pinus sosnowskyi* scrub in the dry foothills of Dagestan.]** *Bot. Ž.* 44 (11), 1959 (1633–9). 18 refs. [Russ.]

Describes the sites and associations where *P. sosnowskyi* is found (sandy or stony slopes, ⩾ 250 m. alt., often with *Juniperus oblonga*), and its value in preventing erosion.

2910. ERDEŠI, J. Na marginama dveju fitocenoza. **[The limits of two [Jugoslavian] phytocoenoses.]** *Šumarstvo* 12 (7/8), 1959 (359–67). 16 refs. [Croat.f.*f.*]

Proposes a new classification of the forest types in the Bačka region of the Vojvodina, and presents data indicating that the '*Quercus robur* subsp. *scutariensis*' of the Skadar region of Montenegro does not in fact differ from the type of *Q. robur*, which will mean re-naming the associations of the area.

2911. BIANCO, P. Querceti a *Quercus trojana* Webb nel territorio di San Michele di Bari. **[Oakwoods of *Q. trojana* in the region of San Michele di Bari.]** *Nuovo G. bot. ital.* (*n.s.*) 45 (1/2), 1958 (43–100). 39 refs. [It.it.e.] A.P.B.

A detailed study of the vegetation types and floristic composition of the relicts of what was probably once an extensive mixed Oak forest.

2912. FEINBRUN, N. **Spontaneous *Pineta* in the Lebanon.** *Bull. Res. Coun. Israel* 7*D* (3/4), 1959 (132–53). 53 refs.

During the summers of 1941 and 1942, *Pinetum pineae* and *Pinetum brutiae* were studied by the author in Southern and Central Lebanon. The analysis of the phytosociological records is tabulated. The relationships of three *Pineta* of the Lebanon, *Pinetum pineae*, *Pinetum brutiae* and *Pinetum halepensis*, with the main Mediterranean vegetation units are discussed. These *Pineta* form part of the sclerophyllous forest belt of Markgraf (1932) and belong to the order *Quercetalia calliprini*, class *Querceta calliprini*. The author supports the view that the *Pineta* are to be regarded as climax associations. These are found in areas governed by specific edaphic conditions, and are surrounded by more extensive areas of the *Quercetum calliprini* climax. The indigeneity of the *Pinetum pineae* forests in the Lebanon is discussed. The alleged introduction of *Pinus pinea* into Lebanon by Fakhr-ed-din in the 17th century is shown to be legendary. The data collected by the author are in agreement with the view that *Pinetum pineae* in the Lebanon is a natural type of vegetation. The opinion expressed is substantiated by: (*a*) the floristic composition of the forest, (*b*) the close correlation found between the location of *Pinetum pineae* forests and that of the Lower Cretaceous sandstone. *From author's summary.*

2913. NAHAL, I. La végétation forestière naturelle dans le nord-ouest de la Syrie. **[Natural forest vegetation in north-west Syria.]** *Rev. for. franç.* 12 (2), 1960 (90–101). 6 refs. [F.]

An account of the region, with a systematic list of forest species and a description of the *Pinus brutia*, *Quercus pseudocerris*, *Cedrus libani*, and *Abies cilicica* associations.

2914. HUANG, C.-P., and T'AN, S. **[A short physical and geographical outline of the A-êrh-shan [Arshan] region of the southern part of the Gt. Hingan Mts.]** *For. Sci., Peking* 1959 (6), (446–51). [Chin.russ.]

The region, which lies between the Mongolian steppe and the coastal plain, has the following forest types: steppe; low-montane broadleaved forest and subalpine broadleaved forest meadow steppe; low-montane coniferous/broadleaved forest steppe; subalpine coniferous/broadleaved forest; subalpine coniferous forest. The S. limit of *Larix gmelinii* is tentatively placed at 46° 40′ N. *Pinus pumila* is found on two site types: volcanic debris of effusive rocks (1170–1230 m. alt.), and on sphagnum bogs on N. slopes (1480–1670 m.). Recommendations are made on regeneration of the main species.

2915. WU, C.-L. **[On the distribution and choice of important tree species for regeneration and reforestation in the mountainous area of W. Szechwan.]**

*For. Sci., Peking* 1959 (6), (465–76 + 2 plates). 8 refs. [Chin.e.]

[Cf. *F.A.* 21 No. 1625.] Discusses the altitudinal ranges and floristic composition of 7 natural vegetation zones: (1) evergreen broadleaved forest; (2) deciduous broadleaved forest; (3) mixed coniferous/broadleaved forest; (4) coniferous (locally including subalpine) forest; (5) alpine scrub; (6) alpine meadow; (7) alpine tundra. Factors affecting the distribution of vegetation are discussed, and suggestions made on the reforestation programme, and on erosion control. The distribution of 23 species (16 of them conifers) is outlined, and species suitable for reforestation and erosion control at different altitudes on various sites are recommended.

2916. TATEWAKI, M., TSUJII, T., and UMEZAWA, A. **[Tatewaki's iconography of vegetation of the natural forest in Japan. V. The Southern Shikoku District.]** *Res. Bull. Exp. For. Hokkaido Univ.* 20 (2), 1959 (511–96 + 13 plates). [Jap.e.*e*.] [Cf. *F.A.* 19 Nos. 1540–1.]

2917. KUROIWA, S. **Ecological and physiological studies on the vegetation of Mt. Shimagare. III. Intraspecific competition and structural development of the *Abies* forest.** *Bot. Mag., Tokyo* 72 (856), 1959 (413–21). 17 refs. [E.e.jap.] I.M.I.

[Cf. *F.A.* 21 No. 1581.] Frequency curves were plotted for (1) tree height, (2) diameter, (3) needle weight, and (4) weight of aerial parts of *Abies veitchii* and *A. mariesii* growing in mixture, and annual mortality was recorded throughout the stand development, except for overmature trees. For (1) N- or somewhat L-shaped curves were obtained and for (2)–(4) only L-shaped curves, those for (3) and (4) being markedly so. Half the annual mortality occurred among suppressed trees in the smallest tree class. The stem diam. and tree height were linearly related to the logarithmic value of tree density, and a linear relationship was observed between (4) and density on a system of log/log coordinates. Total stand b.a. increased gradually in the young stage, decreased slightly in middle life, and increased rapidly again in the fully mature stage. The upper part of the photosynthetic system (p.s.) of the young stand was occupied mostly by the dominants, while in the non-photosynthetic system (n.p.s.) the major parts were occupied by both the dominants and the intermediates. As the young stand developed, the total dry weight of the n.p.s. increased greatly and that of the p.s. slightly, though the leaf-area index remained almost constant.

2918. DEB, D. B. **Forest type studies in Manipur.** *Indian For.* 86 (2), 1960 (94–111). 12 refs.

This is the first attempt to identify and classify forest types in this region. The following main climatic zones with their respective formations are described: (*A*) Tropical: (i) *Tectona*/*Dipterocarpus*, (ii) *Quercus*/*Laurus*/*Schima*, (iii) *Laurus*/*Melia*/*Bauhinia*; (*B*) Montane subtropical: (iv) *Pinus*/*Quercus*, (v) *Sarauja-Phoebe*/*Beilschmiedia*, (vi) *Quercus*/*Engelhardtia*/*Schima*/*Vaccinium*; (*C*) Montane temperate: (vii) *Quercus*/*Machilus*/*Magnolia*/*Acer*/*Betula*; (*D*) Subalpine: (viii) *Rhododendron*/*Betula*.

2919. BHATIA, K. K. **Teak bearing forests of old Madhya Pradesh.** *Indian For.* 85 (12), 1959 (710–22 + 8 photos).

Detailed descriptions of the forests and their floristic composition.

2920. GILLILAND, H. B., and WANTMAN, M. J. **Regenerating high forest on Singapore Island.** *Gdns. Bull.* 17 (2), 1958 (1959), (228–43). 7 refs.

Analyses the vegetation of one of the few surviving relicts of high forest, a Dipterocarp-dominated type, and discusses the results of the application to it of a line-transect sampling method.

2921. MONOD, T. Les grandes divisions chorologiques de l'Afrique. Rapport présenté à la Réunion de Spécialistes sur la Phytogéographie (Yangambi, 19 juillet—8 août 1956). **[The great chorological divisions of Africa. Report presented to the specialist meeting on phytogeography [of Africa], Yangambi 28 July—8 Aug. 1956.]** *Repr.* from *Webbia, Firenze* 13 (2), 1958 (665–8). [It.]

A résumé (in Italian) of the article originally published in French (names of divisions etc. given in French).

2922. PICHI-SERMOLLI, R. E. G. Una carta geobotanica dell'Africa orientale (Eritrea, Etiopia, Somalia). **[A geobotanical map of East Africa (Eritrea, Abyssinia, Somaliland).]** *Repr.* from *Webbia, Firenze* 13 (1), 1957 (15–132 + 1 map, 21 photos). 9 pp. of refs. [It.it.e.]

The map (1 : 5 million), shows 24 vegetation types; the text discusses these, with descriptions of physiognomic features, floristic composition, etc.

2923. HOWARD, J. A. C. **The classification of woodland in Western Tanganyika for type-mapping from aerial photographs.** *Emp. For. Rev.* 38 (4), 1959 (348–64). 16 refs.

Discusses the scope of aerial photography and the difficulty of identifying individual tree species of the *miombo* woodland. The author proposes a classification, based on P. J. Greenway [unpublished] and suitable for type-maping 1 : 30,000 aerial photographs, of 7 main ecological types in the following ascending order of importance: (1) semi-desert; (2) permanent swamp; (3) grassland; (4) forest; (5) thicket, bushland and scrub; (6) wooded grassland; (7) woodland [cf. *F.A.* 11 No. 139]. The identification of these and various sub-types, each with a different sawlog value-potential, from aerial photographs is discussed, with an account of the main species in each. A summary in catena sequence from hill top to valley bottom is presented, with the letter symbols proposed for each.

2924. WILTON, W. C. **Forest types of the Grand Lake and Northwestern Lake areas of Labrador.** *Tech. Note For. Br. Can.* No. 83, 1959. pp. 30. 9 refs.

The classification, based on forest-cover and minor vegetation, gives 8 principal divisions. Close correlation of merchantable volume (m.v.) was found between the different sampling units within a forest type, whereas the m.v.'s were found to differ widely between types. The poorest forest type (Black Spruce/lichen) had a m.v. of ca. 5 cords/acre, while the best type (Fir/Spruce/Birch/rich herb undisturbed type) has 41 cords. The m.v.'s of the types are distributed fairly uniformly in between, giving a general, unweighted average of 22 cords/acre.

2925. Christensen, E. M., Clausen, J. J., and Curtis, J. T. **Phytosociology of the lowland forests of northern Wisconsin.** *Amer. Midl. Nat.* 62 (1), 1959 (232–47). 33 refs. B.A.P.

Presents data on the species composition of these forests, based on 108 stands. The most important trees were *Larix laricina* and *Picea mariana* on the wettest, most acid sites, *Thuja occidentalis*, *Abies balsamea* and *Fraxinus nigra* on intermediate sites, and *Tsuga canadensis*, *Betula lutea* and *Acer saccharum* on the most nearly mesic circumneutral sites. *From authors' summary.*

2926. Ramseur, G. S. **The vascular flora of high mountain communities of the Southern Appalachians.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (7), 1960 (2514–5). O.R.S.

Comprises a taxonomic study of the entire southern Spruce/Fir region, compares the flora of the various isolated areas, studies the stages of succession leading to the climax Spruce/Fir forest, and the geographic ranges of the dominant species, and includes a summary of the taxonomic treatment of *Abies* in eastern North America.

2927. Maysilles, J. H. **Floral relationships of the Pine forests of Western Durango, Mexico.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (5), 1959 (1556–7). O.R.S.

Describes the forested high plateau and *barranca* [ravined] sections of the Sierra Madre in an area of ca. 9000 sq. km. W. and S.W. of Ciudad Durango.

2928. Hueck, K. Bosques secos de la zona tropical y subtropical de la America del Sur. **[Dry forests of the tropical and subtropical zone of South America.]** *Bol. Inst. For. Latino Amer., Mérida* No. 4, 1959 (1–49 + [2] + 25 photos). 99 refs. [Span.e.]

The greater part of the study is devoted to the three most important forest formations of the continent: (1) the Argentinian Chaco, (2) the Brazilian Cerrado, and (3) the Brazilian Catinga. For each, an annotated list is given of the most important species and their uses, with a discussion of ecological conditions and silvicultural problems. (1) is divided into 6 forest types: (*a*) the Algarrobo type of the driest regions with saline soils, characterized by *Prosopis alba* and *P. nigra*; (*b*) the Quebracho type, the most widely distributed, characterized by *Aspidosperma quebracho-blanco* and *Schinopsis lorentzii*; grazing and over-exploitation have had catastrophic results, and this type presents complex silvicultural problems; the 4 remaining types belong to the more humid areas, i.e. (*c*) with *Celtis pubescens* and *Zizyphus mistol*, (*d*) with *Copernicia australis*, (*e*) with *Calycophyllum multiflorum*, and (*f*) with *Tipuana tipu*. Particular reference is made to the status of (2), i.e. whether it is a climax, or secondary succession after fire; (3) is divided into several forest types on the basis of well defined ecological conditions, and contains some important species, such as *Copernicia cerifera* and *Caesalpinia echinata*. Similar but briefer information is given for the forests of the Chilean, Caribbean and Andean regions. *From author's summary.*

2929. Steenis, C. C. G. van. **Vegetation map of Malaysia.** The Author, in collaboration with UNESCO, for the UNESCO Humid Tropics Research Project. 1958. 1 sheet + separate commentary, pp. 8. [E.] Scale 1 : 5,000,000.

A physiognomic map compiled from many sources, indicating 18 types of vegetation: (1) rain forests *s.l.* and 8 variants, viz. (2) dipterocarpaceous, (3) *Agathis*, (4) Borneo Ironwood, (5) *Casuarina junghuhniana*, (6) *Pinus* (*P. merkusii* and *P. insularis*), (7) freshwater swamp and peat, (8) Sago swamp, and (9) Mangrove forests; then (10) secondary forests (seral types of rain forest); open vegetation—(11) savannas, (12) and (13) grassland; seasonal forests—(14) monsoon and (15) Teak forests; and other major cultivations—(16) wet rice-fields, (17) dry fields and (18) plantations.

2930. McKelvey, P. J., and Nicholls, J. L. **The indigenous forest types of North Auckland.** *N.Z. J. For.* 8 (1), 1959 (29–45). 2 refs.

From information gained on a recent primary survey, 20 ecological types have been distinguished in N. Auckland indigenous forests. These are described briefly, with emphasis on structure. *Authors' summary.*

## 2. SILVICULTURE

See also Nos. 2817 *et seq.*, 2975–6, 3891, 3900, 3917, 3923, 3928.

2931. Hummel, F. C. **[Review of *W. E. Hiley* 'Conifers: South African methods of cultivation'.]** *Forestry* 32 (2), 1959 (199–201). [Cf. *F.A.* 20 No. 4353.] With a rejoinder by Hiley.

2932. **[Beech.]** *Forst- u. Holzw.* 15 (2), 1960 (22–40 + 4 plates). Many refs. [G.]

Four papers: The economic position of the Beech forest districts in Lower Saxony as a silvicultural and management problem (*Schmidt*) [the problem is how to deal with high proportions of mature timber with low reserves of young growth]; Artificial regeneration of Beech in Hanover and Brunswick in the 19th century (*Borchers*); Rational stand establishment by natural and artificial means—especially with regard to Beech (*Schlüter*) [general principles, methods and recommendations]; Suiting utilization and conversion to the present state of the Beech market (*Tägtmeyer*).

2933. Seth, S. K., and Desarker, B. K. **Poplar cultivation.** *Indian For.* 86 (1), 1960 (21–7). 19 refs.

A general account of Poplar growing in Europe and America, with more detailed notes on the indigenous Indian species, *Populus euphratica* and *P. ciliata*.

2934. Ragonese, A. E., and Rial Alberti, F. Reseña sobre cultivo y mejoramiento de álamos y sauces en la República Argentina. **[Review of the cultivation and improvement of Poplars and Willows in Argentina.]** [*Docum.*] *10th Sess. Int. Poplar Comm.* No. *FAO/CIP/95L Add.* 1, 1959. pp. 27. 84 refs. [Span.] Limited distribution.

The review, which is amply documented, includes a survey of species and hybrids cultivated in Argentina, methods of raising and establishing Willow plantations, probable yields, pests, and diseases of both Poplar and Willow, and breeding work.

2935. Letourneux, C. La mécanisation des plantations forestières dans les pays tropicaux. **[Mechanization of forest plantations in the tropics.]** *Note tech. Centre Tech. For. Trop.* No. 3, 1960. pp. 118 + 32 photos, 34 drawings. [F.]

Chapter 1 discusses general problems and advantages of mechanization. Ch. 2 analyses costs of machinery, running costs of tractors, costs of accessories, and methods of costing. Ch. 3 describes machines and their use for a number of operations—land clearing, soil preparation, road-making, nursery work, sowing, planting, and tending plantations. This chapter is illustrated by numerous photographs and very clear drawings. Ch. 4 deals with the organization of central depôts for machinery—location, area, lay-out, deployment of staff, organization of maintenance and repair work, and accounting. The final chapter discusses costs of mechanized plantations. The study is based on data collected by the author in Ceylon, Sudan, Ivory Coast, Togoland, the Cameroons, Gabon, the Congo, and Madagascar.

## 22. Silvicultural Systems. Constitution and Composition of Stands; Forms of Stand

### 221. High Forest Systems

See also Nos. 2680, 2952, 2955, 2963–4, 3161, 3594.

2936. Polák, O. Ekonomicky zdůvodnená volba hospodářských útvarů a způsobů. **[Economic basis in choosing silvicultural systems and species.]** *Lesn. Čas.* 5 (6), 1959 (361–78). 9 refs. [Cz.russ.g.]

To test the economic validity of the Czechoslovak edict that clear-felled areas must not be wider than the mean stand height, and not longer than 10 times that amount, clear fellings were made 80, 40 and 20 m. wide and 200 m. long in a Spruce stand of mean height 20 m. A further part of the stand was worked by group fellings, and a control area left completely untouched. Preliminary findings on microclimatic conditions in the various clearings are given, but it is too early as yet to form definite conclusions.

2937. Ruprich, J. Výzkum ekonomicky zdůvodněné velikosti holiny. **[Investigation on the economic size of felling areas.]** *Lesn. Čas.* 6 (1), 1960 (24–31). [Cz.russ.g.]

[Cf. preceding abstract.] Though logging costs per cu.m. of timber decrease with increasing size of felling area, regeneration and afforestation costs rise. Since, in these investigations, data on the latter costs are not yet complete, it is still not possible to pronounce on the economically advisable size of felling area.

2938. Reynolds, R. R. **Eighteen years of selection timber management on the Crossett Experimental Forest.** *Tech. Bull. U.S. Dep. Agric.* No. 1206, 1959. pp. 68. 34 refs.

Presents costs, returns, and silvicultural observations from a 958-acre study area carrying understocked forest of second-growth Southern Pine and hardwoods, that has been under closely controlled management and the selection system since 1937. Based on a 100%, 1-in.-diam. inventory, 40-acre compartments were allotted to one or other of three 8-compartment management areas starting with roughly the same variation in Pine growing stock, for cutting on 3-, 6- or 8-year cycles so as to determine their effect on growth and returns. A conservative cut based on a sawtimber growth of 7% was fixed, and realized, subject to silvicultural considerations, from the top diameter classes, plus thinnings and improvement fellings. Though a substantial % of high-grade logs was obtained from the first cutting, which was essentially for improvement and sanitation, it soon became clear that the Oaks, Gums and other hardwoods could not compete with the *Pinus taeda* and *P. echinata* in growth rate, quality, or return per unit area. From 1942, therefore, all merchantable hardwoods (≮ 5 in. d.b.h.) were removed at each cut, unmerchantable material being girdled, and silviculture was concentrated on the Pines. The results of 18 years' intensive management are considered very promising.

2939. Lachaussée, E. La hêtraie de Haut-Fays (Belgique) traitée par la méthode du contrôle. **[The Beech forest of Haut-Fays, Belgium, managed by the *méthode du contrôle*.]** *Bull. Soc. For. Franche-Comté* 29 (8), 1959 (423–35). 6 refs. [F.]

An account of the forest, for centuries treated as coppice with standards, then converted to high forest, and since 1930 managed by the *méthode du contrôle*. In 1930 there was a large proportion (> 31%) of Sessile Oak, but this is disappearing and the forest is evolving towards pure Beech with very acid humus. [Cf. *F.A.* 13 No. 2330.]

2940. **Growth of residual Lodgepole Pine.** *Extr.* from *Rep. Intermt. For. Range Exp. Sta. 1958*, 1959 (8).

Heavy partial pulpwood cuttings in an even-aged overmature stand in Montana, with a b.a. of 115 sq. ft. and a volume of 4400 cu. ft./acre, led to serious damage, mainly through windthrow; in 11 years the per acre residual stand decreased from 99 trees of 33 sq. ft. b.a. and 1200 cu. ft. to 56 trees of 15 sq. ft. b.a. and 538 cu. ft.

2941. Vestjordet, E. Bledningsskogen på ny i søkelyset. **[Selection forest in the limelight again.]** *Norsk Skogbr.* 6 (3), 1960 (101–2). [Nor.]

Criticizes articles by Bøhmer [see *F.A.* 19 No.

2864; 21 No. 2952], stressing the shortage of trees in the 'recruitment classes' and presenting graphs based on Bøhmer's data showing the decreasing tendency in p.a.i.

2942. KUGELBERG, V. Skärmställning och överståndare II. **[Shelterwood systems and reserve trees. II.]** *Skogen* 46 (23), 1959 (478–80). [Sw.]

Presents data for a further two plots [cf. *F.A.* 21 No. 1626] and gives an example of an economic calculation for a 90-year Pine stand treated either by clear felling or as shelterwood with reserves; the latter proved more profitable.

2943. HÄGGSTRÖM, B. Skärmställning och överståndare. **[Shelterwood systems and reserve trees.]** *Skogen* 47 (5), 1960 (99–100). [Sw.]

Discusses articles by Kugelberg [see preceding abstract] and presents further comparative data; these show rather better financial yields (receipts minus the costs of planting and cleaning in establishing regeneration) for an increment felling at 90 years (*a*) followed by clear felling and planting at 106 years or (*b*) retaining e.g. 40 seed-trees/ha. at 100 years, than for shelterwood with reserves.

2944. HILEY, W. E. **Two-storied high forest.** *Forestry* 32 (2), 1959 (113–6). 2 refs.

The system has been adopted at Dartington with Japanese Larch (*Larix leptolepis*), and it has been suggested that it works there because Japanese Larch grows fast. It is argued in this paper, however, that the system is best adapted to rather slowly growing trees, and the reason for its use with Japanese Larch is that this species is characterized by a rapid height growth but a small radial c.a.i., so that, unless the trees are isolated, they make extremely narrow annual rings. With Douglas Fir and Sitka Spruce the annual rings might become too broad if this treatment were applied, except at a rather advanced age. Nevertheless, the system has certain other advantages and, to attain these, it may be useful to adopt it more extensively, even if the annual rings become broader than we like. *From author's summary.*

### 222. Coppice, Pollarding and Lopping Systems

2945. OPHOVE, C. H. D'. Le peuplier dans un taillis. **[Poplar [introduced to form standards] in coppice.]** *For. France* No. 93, 1960 (6–7). [F.] X.

Describes a system successfully applied in the Oise Department to some 600 ha. of coppice with standards, where the failure of Oak regeneration makes it difficult to find enough Oak standards. The whole stand, consisting of Oak standards and Ash, Alder, Hornbeam or Hazel coppice, is clear-felled, and Poplar (preferably the clone 'I.455') is planted at a rate of 120–180/ha. in holes 0·75 m. square. The large planting holes are necessary to give plenty of root-room to the young trees and enable them to get away from the coppice regrowth. The system is only suitable for moist soils (water-table $\ngtr$ 1·5–2·5 m. from the surface). Detailed figures for costs and returns are given. In favourable circumstances a return of 6% on capital may be obtained for a rotation of 30 years.

### 226. Changes of Silvicultural System. Conversion (by System or Species)

See Nos. 3003, 3160.

### 228. Constitution and Composition of Stands; Choice of Species and Form of Mixture; Tree Classes; Forms of Stand

See also Nos. 2644, 2675–6, 2882, 2917, 2954, 3520, 3564, 3572, 3581.

2946. ECKHART, G. Waldentwicklungsmöglichkeiten in der Katastralgemeinde Haslau, dargestellt an Hand von Aufwuchsanalysen. **[Structural analyses of young growth as a guide to the development possibilities of forests in Haslau district [E. Styria].]** *Cbl. ges. Forstw.* 76 (4), 1959 (193–214). 20 refs. [G.]

In connexion with a survey and land-use plan of an area containing much poor-quality farm woodland, analyses are presented for 9 representative (not randomly chosen) quadrats, 5 × 5 m., recording spatial distribution of species, diameters, heights, and two years' height growth, as a means of ascertaining trends and as a basis for silvicultural action. Some of these extensive areas, consisting of mixtures of Alder and/or Birch, with some Spruce, Larch, Pine and Silver Fir, have grown up under very open, degraded, selection forests, others on former coppice, relics of a system of '*Brandwirtschaft*'. This system of great antiquity, based on a rotation of coppice—burning—tillage—pasture—coppice, is still being practised in parts, and was compulsory practice for many centuries in order to prevent further clearing of high-forest areas for agriculture.

2947. KRAUSS, H. Das Tannenproblem—ein synökologisches Problem? **[Silver Fir—a problem of synecology?]** *Forst u. Jagd* 10 (1), 1960 (33–5). 1 ref. [G.]

In addition to stressing the need of Silver Fir for an environment of uneven-aged mixed stands—with carefully regulated proportions to prevent excessive moisture competition by Spruce, and poor regeneration conditions under Beech—the author discusses the great differences in vigour observed in the hard winter of 1955–56, when some Silver Firs were unharmed and others died [cf. *F.A.* 19 No. 747].

2948. TIMOFEEV, V. P. Struktura naibolee produktivnyh nasaždenij listvennicy. **[The structure of the most productive Larch stands.]** *Izv. Timirjaz. Sel'.-hoz. Akad., Moskva* No. 6, 1959 (129–42). 25 refs. [Russ.e.] O.W.

[Cf. *F.A.* 21 Nos. 1636, 1748.] Discusses the composition and constitution of 8 outstanding artificial stands of Larch (*Larix sukaczewii*, *L. decidua*, or *L.d.* var. *polonica*) in various parts of European Russia. It is concluded that the best-yielding Larch are in closed, mixed stands with a relatively small number of upper-storey Larch.

2949. YLI-VAKKURI, P. Harvennusmetsiköiden optimipuusto. **[The optimum growing stock before thinning.]** *Metsät. Aikak.* 1959 (12), (416–9). 10 refs. [Fi.e.]

The sharp turning point in the increment of a stand, which occurs when the stand is still fairly young, is attributed not to sudden ageing but to the probable fact that, in the Finnish climate, stand development itself causes a deterioration in growing conditions; the rapid increase in volume increment up to the turning point is associated with an increasingly dense canopy, causing a decrease in soil temperature and in amounts of precipitation reaching the ground, and a decrease in the snow cover, with a deeper layer of soil frost and less mellowing of the humus. It should be possible to ascertain for different conditions the maximum growing stock for which reduction in increment is compensated by the increased stocking. It would probably be possible to increase total yield by thinning in such a way as to maintain ecologically optimum conditions in the stand. *From author's summary.*

2950. Willan, R. G. M. **Pure or mixed plantations?** *Nyasald. Fmr. For.* 5 (1), 1959 (15–7). 2 refs.

A general discussion of the question, with examples from different continents. The danger of stagnation at a later stage in pure plantations of *Gmelina arborea* recently established in Nyasaland is pointed out.

2951. Kakli, M. S. **Some biological aspects of pure and mixed coniferous plantations in lower Michigan.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (5), 1959 (1513). O.R.S.

Part 1, based on literature dating from 1500, examines the merits claimed in general for pure and mixed stands. Part 2 studies the diameter, height, and volume increment, survival, and attacks by insects and disease, of individual trees and stands, in a number of 35-year pure and mixed (alternate-row) plantations of Jack, Red, Scots and White Pines. The mutual effect of the various species on each other's survival and increment is discussed in some detail. Attacks by insects and rusts on a less susceptible tree species appeared to increase when it was mixed with a more susceptible one. Recommendations are that the four species should not be grown in alternate-row mixtures, that Jack Pine should be limited to poor, and Red Pine to good and medium sites, and that White and Scots Pines should not be grown in the area studied.

## 23. Regeneration and Formation of Stands

See also Nos. 2914–5, 2920, 3402, 3602–3, 3924.

### 231. Natural Regeneration

See also Nos. 2655, 3512.

2952. Bøhmer, J. G. Noen foreløbige refleksjoner over stripehugst og annen snauhugst i Verdal. **[Preliminary reflections on strip felling and other clear felling in Verdal [Trøndelag].]** *Tidsskr. Skogbr.* 67 (4), 1959 (196–206). [Nor.]

Presents tabulated data on stocking [chiefly Spruce?] on the strips and other clear-felled areas, and on stocking, volume, and increment % in the adjacent stands, and discusses the problem of ensuring adequate stocking (by combinations of planting and natural regeneration) and of avoiding the need to fell small immature trees. [Cf. *F.A.* 21 No. 2941.]

2953. Fairbairn, W. A. **A note on light intensity requirements of *Luzula*.** *Sylva, Edinb.* No. 40, 1959/1960 (18–21 + 1 plate). 1 ref.

From a preliminary study it is concluded that, in order to obtain natural regeneration in a forest stand, or to use artificial regeneration without the expense of clearing *Luzula sylvatica*, it is necessary to maintain a canopy, before regeneration operations, under which the light intensity is $< 20\%$ of that in the open, and that preferably it should be between 11 and 20%.

2954. Hegardt, S. Björken i våra föryngringar. **[[The treatment of] Birch in Swedish regeneration areas.]** *Skogen* 47 (1), 1960 (6–7). [Sw.]

Compares two treatments of clear-felled areas: (1) in which Birch regeneration is allowed to become established and is interplanted with Spruce 5 years after the clear felling, the Birch crop being harvested at 35 and the Spruce at 50–60 years; (2) in which the clear-felled area is planted with Spruce one year after felling, all hardwoods are removed after 10 years, and the Spruce is felled at 75–90 years. Concludes that (1) will be economically as profitable as (2) when the price at motor road for 2-m. strip-barked Birch pulpwood is $\not<$ Kr. 22 to 22·50/stacked cu.m.

2955. Šimanjuk, A. P. Estestvennoe lesovozobnovlenie na koncentrirovannyh vyrubkah v sosnovyh lesah taežnoj zony Evropejskoj časti SSSR i puti ego ulučšenija. **[Natural regeneration on concentrated fellings in the taiga Pine forests of European Russia, and ways of improving it.]** *In* 'Sbornik Statej po Resul't. Issled. v Oblasti Lesn. Hoz. i Lesn. Prom. v Taežnoj Zone SSSR'. Moscow. 1957. pp. 82–109. 80 refs. [Russ.]

Reviews the literature [all Russian], and discusses the various growth zones in the taiga; seed sources for felled areas, and measures to assist natural regeneration; the trends of natural regeneration in different Pine forest types, with actual data from regeneration surveys; and natural regeneration as affected by width of felling area.

2956. Tsuda, K. **[On the growth and nutrient contents of young Todo-Fir trees in natural regeneration forest in Kotanbetsu district.]** *Extr.* from *Ann. Rep. For. Exp. Sta., Hokkaido 1958*, 1959 (50–66). 14 refs. [Jap.jap.e.*e*.]

The lay-out of the study area is described. Seedling growth was generally good on S. slopes and on plots where *Abies mayriana* vegetation types predominated. Regeneration was good on rotten wood. Seedling contents of N were low compared with those of P and K. Contents of nutrients were higher in seedlings growing on rotten wood than on those in soil.

2957. Gračanin, Z. Zur Bodenentwicklung und -mikromorphologie unter natürlichen *Pinus nigra*-Wäldern in Kroatien. **[Soil formation and micromorphology under natural *P. nigra* stands in Croatia.]** *Allg. Forst- u. Jagdztg.* 131 (2), 1960 (37–9). 3 refs. [G.e.]

Describes investigations in a relict stand of *P. nigra* in Borova Draga near Rijeka at 400–700 m. alt. Regeneration and growth were good on almost bare dolomitic rock, on very stony rendzina and on some mull-like rendzina moder; but on more humid mull-rendzina or slightly degraded rendzina, competition of grasses and herbs was too great. *From author's summary.*

2958. TEPPER, H. B., and BAMFORD, G. T. **Natural regeneration in bottomland hardwoods of Southern New Jersey**. *For. Res. Note Ntheast. For. Exp. Sta.* No. 93, 1959. pp. 4. 3 refs.

Describes changes observed in the composition of two 1-acre plots (i.e. within reach of wind-dispersed seed sources) in 75- to 80-year mixed stands (Oaks predominating) that had received a first light shelterwood cut in 1946 and a further (salvage) cut in 1953. Contrary to other experience in the area the number of desirable trees in the understorey increased and undesirable shrubs and herbs declined. In the reproduction, Sweet Gum [*Liquidambar styraciflua*], a wind-dispersed species, predominated, and Oak had much decreased.

2959. HOSNER, J. F., and MINCKLER, L. S. **Hardwood reproduction in the river bottoms of Southern Illinois**. *For. Sci.* 6 (1), 1960 (67–77). 14 refs.

A study was made of 62 sample stands. In general it was found that an adequate number of seedlings of desirable forest species occurs initially on all the sites studied. Except for newly formed land, where Cottonwood predominates, American Elm, Boxelder, Green Ash and Silver Maple were the most strongly represented species. [Cf. *F.A.* 21 No. 2881.]

2960. **Ashbed effects**. *Extr.* from *Rep. For. Dep. W. Aust. 1958/59*, 1959 (27).

At the centre of an ashbed, 2-year-old Karri [*Eucalyptus diversicolor*] seedlings may be 10–12 ft. high, compared with 5–6 ft. at the edge of the ashbed and 1–2 ft. off the ashbed. This initial height-growth advantage of 5 ft. is maintained during the young life of an even-aged stand. Recent observations of seedlings on ashbeds have revealed a strong development of fibrous lateral roots with numerous rootlets carrying terminal mycorrhizal bifurcations; this has not been observed in seedlings off the ashbed.

2961. **Jarrah regeneration**. *Extr.* from *Rep. For. Dep. W. Aust 1958/59*, 1959 (28–9).

The reassessment of a number of regeneration plots of Jarrah (*Eucalyptus marginata*) has indicated that its successful regeneration depends largely on the presence of well developed lignotuberous advance growth at the time of felling. Under the undisturbed canopy of virgin forest, seedlings and advance growth up to 3 ft. high become established in varying quantities, greater numbers being found under a more open canopy and on old ashbeds. These plants will persist in an apparently suppressed condition for long periods, and dormant advance growth well over 20 years old has been observed. Dynamic development as saplings is confined to openings in the forest, created naturally or by fellings. [Cf. *F.A.* 17 No. 2580; 19 No. 257.]

2962. NEEDHAM, R. H. **Problems associated with regeneration of *Eucalyptus gigantea* in the Surrey Hills [Tasmania] area.** *APPITA, Melbourne* 13 (4), 1960 (136–40). 1 ref.

Describes the geology, location, climate, history and timber types, particularly the three main *E. gigantea* forest types: (*a*) *E. gigantea* and *Poa caespitosa*, (*b*) *E. gigantea* with an understorey of *Drimys aromatica* scrub, and (*c*) *E. gigantea* with an understorey of rain-forest species, principally *Nothofagus cunninghamii*. The management of each type to ensure adequate *E. gigantea* regeneration is outlined. The young regrowth must be protected from fire, herbivorous animals and scale insects, and understorey competition must be removed. Satisfactory regeneration can be got without burning of slash, and game populations can be drastically reduced by furrow poisoning with '1080' (Na fluoracetate).

2963. GROSE, R. J. **Effective seed supply for the natural regeneration of *Eucalyptus delegatensis* R. T. Baker syn. *Eucalyptus gigantea* Hook.f.** *APPITA, Melbourne* 13 (4), 1960 (141–8). 2 refs.

[Cf. *F.A.* 19 No. 1586.] Studies in N.E. Victoria showed that there is usually some flowering each year, but no periodic production of useful seed crops was apparent. In an even-aged stand, seed production per tree varied with aspect, crown class, crown leafiness, and the degree of insect infestation. Flowering usually occurs in Feb. and March, the seed crop remaining on the trees for $\geqslant$ 2 years. Some seed is cast in most months, the peak being from late Feb. to early April. The effective dispersal distance from isolated seed-trees is ca. 1 tree-height. With a good seedbed, 3–4 good-quality dominants per acre should provide an effective seed source. In exposed situations, groups or strips of seed-trees, or a partial-cut method, may have to be used. Fire appears a practicable and effective means of seedbed preparation; where it cannot be used, mechanized tillage will help.

2964. CUNNINGHAM, T. M. **Seed and seedling survival of *Eucalyptus regnans* and the natural regeneration of second-growth stands.** *APPITA, Melbourne* 13 (4), 1960 (124–31). 4 refs.

A high % of the seed is taken by insects and some seeds are killed by high soil temperatures and fungi. Most of the rest germinates within one year of its being shed and no store of seed accumulates in or on the forest floor. In Victoria, peak germination of seed from natural sources occurs in late autumn. An induced dormancy prevents most seed from germinating in late spring and summer, but this dormancy is removed during autumn. During the first year after germination, winter losses of seedlings can be more important than summer losses. Early summer deaths of very young seedlings may be caused by surface drought or lethal high surface temperatures. Winter losses mainly follow infection by soil fungi. These losses are increased by dense shade. The residual understorey, which often provides a bar to regeneration in cut-over virgin forests, is not likely to be such a problem in second-growth stands, but difficulties in providing an adequate seedbed will be encountered. Virgin stands of *E. regnans* have generally been cut on the seed-tree system, with cull trees providing a source of seed. Cull trees in many second-growth stands provide little seed. Economic methods of cutting to provide an adequate source of seed must be developed or the alternative of artificial regeneration adopted. Several methods of cutting second-growth stands to achieve regeneration are discussed. *From author's summary.*

2965. GILBERT, J. M. **Regeneration of *Eucalyptus regnans* in the Florentine valley.** *APPITA, Melbourne* 13 (4), 1960 (132–5).

The virgin stands are usually even-aged, with an understorey of rain-forest species. *E. regnans* prefers a bare seedbed; the understorey forms an absolute barrier to *E. regnans* regeneration unless it is broken (e.g. by burns); and fencing of regeneration areas may be necessary to reduce browsing damage. Broad recommendations for regeneration treatment are drawn up according to forest type, logging method and seed supply.

2966. FARRER, R. P. **The first eight years on the Rondo.** *Emp. For. Rev.* 39 (1), 1960 (89–93).

Gives an account of methods used on the Rondo plateau Reserve, Southern Province, Tanganyika, in regenerating Mvule (*Chlorophora excelsa*) after exploitation. The plateau is 2000–3000 ft. up, within 50 miles of the coast, with ca. 40 in. of rain annually. Exploitation of Mvule began in 1949, and a compensatory planting scheme was begun soon after. The high sapwood content, and thus low value, of thinnings led finally to planting in small clumps at final crop-tree (30 × 30 ft.) spacing on burnt-over patches. Populations of the Mvule gall fly, *Phytolyma lata*, are apparently kept in check by the long dry season, though the snail *Achatina fulica* is a serious pest in young plantations. Natural regeneration has been achieved by burning old stumps (75% then produce suckers) and by root wounding. Teak plantations have reached 34 ft. at 7 years and trials are in progress with *Pinus caribaea*, *P. elliottii*, *P. radiata* and *P. patula*.

2967. CANOV, C. Vlijanie na njakoj faktori vărhu izdănkoproizvoditelnata sposobnost na goruna i cera. **[Influence of some factors on the coppicing ability of *Quercus sessiliflora* and *Q. cerris*.]** *Gorsko Stopanstvo* 15 (5), 1959 (19–26). [Bulg.bulg.]

The coppicing ability of *Q. cerris* decreases from 600 to 1000 m. alt., both as regards the % of stumps that coppice, and the number of shoots per stump. *Q. sessiliflora* is less affected by increasing altitude. Data are tabulated on the heights and diameters of coppice shoots at 600, 800 and 1000 m. alt., and on the relations between diameter of stump (up to 25 cm.) and coppicing ability (i.e. % of stumps that coppice, number of shoots per stump, shoot mortality, and height and diameter of shoots). In both species, all values grew generally poorer with increasing stump diameter. Rates of growth of coppice shoots in the 2nd, 3rd, and 4th years after clear felling are also compared.

2968. LARSON, M. M. **Regenerating Aspen by suckering in the Southwest.** *Res. Note Rocky Mt. For. Range Exp. Sta.* No. 39, 1959. pp. 2. 1 ref.

In summer and autumn of 1949, different treatments were applied to a residual stand of mature Aspen (*Populus tremuloides*) after 50% felling, on ¼-acre plots in each of 3 blocks, as follows: summer felling, girdling, or poisoning, and autumn felling or girdling, with a control plot. Suckers were counted in Aug. 1949, Aug. 1951 (when numbers of suckers reached a maximum), July 1953, and Aug. 1956. In spring 1951 block B was fenced against domestic livestock (chiefly sheep), but not excluding deer. From 1949 to 1956 neither type nor season of treatment had any significant effect on number or height increment of suckers. But by 1956, suckers in fenced block B averaged 134·1 in. at 6696/acre vs. 106·0 in. at 891/acre for block A (unfenced). Several plots in A were bare. It is concluded that Aspen stands similar to those studied need only protection from browsing to ensure adequate regeneration after a commercial felling. [Cf. *F.A.* 17 No. 2664.]

## 232. Artificial Regeneration

See also Nos. 2818–9, 3115.

2969. Sondernummer: Forstkulturen. **[Special number: Plantations.]** *Allg. Forstzeitschr.* 15 (10), 1960 (129–57). [G.]

Includes articles on: Angle planting (*G. Reissinger*) [cf. *F.A.* 20 No. 312]; Piece work in [nurseries,] planting, cleaning and fencing of plantations and in pruning (*K. Gutsweiler*); Mechanization (*W. Raiss*) [equipment for soil preparation, planting and sowing, cleaning, etc.]; Ball planting of large conifers (*Loets*) [describing the Flensburg spade, with a curved blade 20 cm. wide and 35 cm. long, used with success chiefly for transplanting wildings or over-dense stock of *Abies alba* but also *A. grandis*, Douglas Fir, Japanese and European Larch, Beech and Pedunculate Oak up to 1·30 m. high (but not Spruce > 70 cm.), along with a polythene bag for transporting the balled plants]; and Establishment of Spruce/Beech mixtures with saplings (*R. Reissinger*) [using stock 2 m. high, singly or in groups of 7, planted in advance under the old stand or on the clear-felled site]. [Cf. *F.A.* 21 No. 3197.]

2970. CH'ÊN, F.-S. **[Problems in rearing Chinese Fir [*Cunninghamia lanceolata*].]** *For. Sci., Peking* 1958 (4), (414–20). [Chin.]

Discusses preparation of site (in the forest with side shade), sowing density and plant % (tables), season and methods of sowing and planting, nursery shading and diseases, notably root-rot.

2971. BOALER, S. B. ***Conocarpus lancifolius* Engler in Somaliland Protectorate.** *Emp. For. Rev.* 38 (4), 1959 (371–9). 5 refs.

*Conocarpus lancifolius* has been used since 1952 in coastal plantations near Berbera where there is brackish groundwater at 5 ft., and has grown better than other species tried. Nursery and plantation techniques are described. In 1959 the mean height of the 10 tallest trees in a sample plot was 20 ft., and of the 10 smallest 13½ ft. The trees were then 4½ years old and had already fruited. The advantages of *C. lancifolius* as a plantation tree for possible use outside the Protectorate are (1) tolerance of extreme heat and extremely low r.h. and rainfall; (2) tolerance of high mineral concentrations in the soil water; (3) rapid early growth; (4) pyramidal habit. Several seed lots exported have, however, failed to germinate, and in Mombasa (Kenya), *Pestolaria* damping-off fungi destroyed all seedlings. [Cf. *F.A.* 13 No. 2894; 18 No. 2819.]

### 232.1. Choice and Trial of Species, Races, etc.

See also Nos. 2971, 3107–9, 3111–3, 3117, 3166–70, 3172, 3448.

2972. Lines, R. **Common Silver Fir in Britain.** *Scot. For.* 14 (1), 1960 (20–30). 22 refs.

Discusses the extent of its use in Britain, its susceptibility to *Adelges* pests, provenance trials abroad, and the selection of resistant individual trees. There is need for more research on provenances, silvicultural methods, and chemical control of *Adelges* pests before *Abies alba* is written off as an unsuitable species for forestry in Britain.

2973. Pintarić, K. Studie zum Lärchenanbau in Bosnien. **[The possibility of growing Larch in Bosnia.]** *Rad. Poljoprivred.-Šum. Fak., Sarajevo (Šum.)* 2 (2), 1957 (17–88). 132 refs. [G.g.croat.]

A detailed account of studies to determine which parts, if any, of Bosnia are suitable for growing Larch, and also the best provenances to use. The site requirements of Larch outside its natural range are determined from copious W. European literature, and an account is given of climatic conditions and forest types of Bosnia, and also of the previous slight exerience with Larch in Bosnia. It is concluded that Larch should be planted on Oak/Hornbeam and on montane Beech sites, where suitable soils occur. Trial plantings should be made chiefly with provenances from the Tyrol, and also from the Lower Tatra, Poland, and Swiss areas at the limits of the Larch's natural distribution.

2974. Džekov, S. Prvi rezultati komparativnog gajenja klonova *P. robusta*, *P. regenerata* i *P. thevestina* na području Skopske kotline. **[Preliminary results of the comparative cultivation of clones of *Populus* × *robusta*, *P.* × *regenerata* and *P. nigra* var. *thevestina* in the Skopje basin.]** *Topola, Beograd* 3 (11), 1959 (895–907). 4 refs. [Serb.g.*g*.]

The experiment was laid out in 1955 with 1 + 1 plants of Poplar spaced at 2 × 4 m., and the rows interplanted with rows of *Ulmus laevis*. Four years after planting, mean height and d.b.h. of *P.* × *robusta* (*a*), *P.* × *regenerata* (*b*), and *P. nigra* var. *thevestina* (*c*) were respectively 14 m. and 12·20 cm., 12·25 m. and 13·60 cm., and 10·15 m. and 7·40 cm. Height c.a.i. of (*a*) three years after planting was 4 m. and the following year 4 m. or less, that of (*b*) after four years was 4 m. with a tendency to further increase, whereas that of (*c*) was considerably lower [3·50–3·60 m. after four years]. Diam. increment of all three Poplars reached a maximum, (*a*) 5 cm., (*b*) 4·9 cm. and (*c*) 2·36 cm., two years after planting; the subsequent decline in the increment was most rapid for (*a*). Volumes per ha. over bark and under bark respectively were (*a*) 108 and 94 cu.m., (*b*) 99 and 88·5 cu.m. and (*c*) 30·6 and 27 cu.m. All three Poplars reached their maximum volume increment three years after planting; (*a*) and (*b*) showed similar curves, with a tendency to earlier culmination for (*a*), whereas volume increment of (*c*) was very much lower. *From author's summary.*

### 232.11. Species Trials, including Forest Gardens, Trials of Exotics etc.

See also Nos. 2950, 2966, 3002, 3141, 3180–5, 3255, 3894.

2975. Sondernummer: Küstentanne (*Abies grandis*). **[Special number: *A. grandis*.]** *Allg. Forstzeitschr.* 15 (7), 1960 (83–100). 40 refs. [G.g.]

Includes the following articles: Experience with *A. grandis* in Westphalia (*Burchard*) [yield, silviculture, uses]; Development of *A. grandis* in trials in Bavaria, now in their third decade (*E. Rohmeder* and *R. Dimpflmeier*) [yield, and resistance to frost, game damage, *Adelges* and fungi were better than for *A. alba*]; A comparison of *A. grandis* and *A. alba*, and mixtures of *A. grandis* and Douglas Fir (*F. A. Querengässer*); *A. grandis* and soil amelioration (*W. Alpers*) [planting trials at Syke on poor sands with raw humus showed good responses, particularly to full cultivation and liming]; and The properties of *A. grandis* wood (*W. Knigge*) [includes results for samples from 9 W. German stands aged 21–111 years and American data].

2976. Garfitt, J. E. **Atlas Cedar: a forest tree.** *Quart. J. For.* 54 (1), 1960 (54–9). 17 refs.

Reviews French Forest Service experience with *Cedrus atlantica* as a forest tree: silvicultural requirements, methods of establishment, natural regeneration, silvicultural methods and uses of the wood. There is evidence that *C. atlantica* will grow well in Britain, and it may be a useful species for some of the more difficult chalk and limestone sites in the U.K.

2977. Holubčík, M. Príspevok k otázke pestovania cudzokrajných drevín v našich porastoch. **[Raising exotics in Czechoslovak stands.]** *Lesn. Čas.* 6 (1), 1960 (64–75). 10 refs. [Slovak.]

Discusses very briefly experience with and prospects of *Pseudotsuga taxifolia*, *Abies nordmanniana*, *Pinus strobus*, *P. peuce*, *Picea sitchensis*, *Larix leptolepis*, *Sequoia gigantea*, *Metasequoia glyptostroboides*, *Thuja plicata*, *T. orientalis*, *Chamaecyparis lawsoniana*, *C. nootkatensis*, *Tsuga canadensis*, *T. heterophylla* and a few broadleaved species.

2978. Białobok, S. Ausländer-Holzarten auf Versuchsflächen in Polen. **[Exotics on Polish trial plots.]** *Arch. Forstw.* 8 (10), 1959 (865–84 + 2 maps). 36 refs. [G.g.russ.e.]

Discusses mainly 19 conifers and 7 hardwoods (*Quercus*, *Juglans* and *Carya* spp.), the location, climate, and age of the trial plots (many in former Germany), the species, economic potential, etc., chiefly on the basis of German and Polish literature, much of it pre-war.

2979. WIERSMA, J. H. Inventarisatie van de moeraseik in Nederland. **[Inventory of *Quercus palustris* in the Netherlands.]** *Ned. Bosb. Tijdschr.* 32 (3), 1960 (90–5). 3 refs. [Du.]

Presents a table showing number of trees (usually 1 or 2, or unspecified numbers in roadside plantings), height, d.b.h., stem form, soil, fruiting, etc. for 20 districts. The data suggest that the species is worth a trial on heavy soil in the Netherlands.

2980. SOUDIS, B. Tachyauxē dasoponika eidē. **[Fast-growing forest species.]** *Das. Chron.* 1 (13/14), 1959 (599–603). [Gk.]

Lists, with brief notes, the Poplar clones and hybrids under trial in Greece and recommends certain *Eucalyptus* spp. for introduction in specified areas. As regards conifers, the 5 species established in 1954 at the experimental stations for fast-growing conifers at Drama and Perithorion (in Kata Nevrokopion) have all so far shown good height growth, *Pinus peuce* from Almopia best of all.

2981. ŠPIRANEC, M. Močvarski taksodij i mogućnost njegova uzgoja u našim krajevima. **[*Taxodium distichum* and its possible cultivation in Jugoslavia.]** *Šum. List* 83 (6/7), 1959 (182–94). 23 refs. [Croat.f.]

Gives a taxonomic description and details of its silvicultural requirements and wood uses. Presents data on b.a., d.b.h., height, volume and volume increment of a 25-year stand in Motovun forest, Istria. Recommends trials in the lower valley of the Neretva (Dalmatia). *From author's summary.*

2982. DELVAUX, J. Production et plantation de pins dans le Haut-Katanga. **[Propagation and planting of Pines in Haut-Katanga.]** *Bull. Soc. For. Belg.* 66 (12), 1959 (529–56 + 14 photos). [F.]

Detailed account of nursery and plantation techniques evolved for exotic Pines (*Pinus khasya*, *P. insularis*, *P. pseudostrobus* and *P. patula*) in the Haut-Katanga region of the Belgian Congo.

2983. UBEDA MOLINA, J. Normas básicas para la implantación de arboretos mínimos de experimentación forestal. **[Basic principles for setting up small arboreta for trials of forest trees.]** *Rev. for. argent.* 3 (4), 1959 (117–26). 11 refs. [Span.]

A network of small arboreta for permanent and systematic trials of species in each ecological region of Argentina is the only answer to the problem of choice of species for afforestation. Suggestions are briefly presented for the setting up of such arboreta, covering siting, lay-out, choice of species, provision of plants, keeping of records, and practical problems connected with installation and running.

2984. COZZO, D. Informaciones sobre el cultivo del paraíso 'gigante' (*Melia azedarach*) en Misiones, Argentina. **[The cultivation of *M. azedarach* in Misiones, Argentina.]** *Rev. for. argent.* 3 (4), 1959 (127–33). [Span.]

Presents general information on the tree, its silvicultural characters, and the wood, with data on the structure and development of 10 privately owned plantations in Misiones ranging in age from 5 to 11 years. The best initial spacing appears to be 2 × 2 or 2 × 2·5 m. Initial thinnings to 3 × 3 m. should be made not later than the fifth year, and again before the tenth year to 4 × 4 m., by which time the tree will have reached its maximum height, but will continue to increase in diameter. The stands measured at the age of 10 years, carrying ca. 1000 trees/ha., already contained individuals of more than 30 cm. in diam., though in varying and not very high proportions. In general, a m.a.i. of ca. 30 cu.m./ha. may be expected.

2985. LAMPRECHT, H., and FINOL, H. Programa de estudios sobre coníferas exóticas de los Andes venezolanos—primeros resultados de los experimentos. **[Programme of studies on exotic conifers for the Venezuelan Andes—preliminary results of experiments.]** *Bol. Inst. For. Latino Amer., Mérida* No. 4, 1959 (50–79 + [2] + 4 photos). 15 refs. [Span.e.]

Discusses coniferous species suitable for tropical America and their selection on an ecological basis for various parts of Venezuela, and presents a report on the joint plan (begun in 1954) of the Faculty of Forestry and the Instituto Forestal Latino Americano for the establishment of experimental plots for conifers. Some preliminary results are given, chiefly for *Pinus radiata*, but also for *P. caribaea*, *P. taeda* and *Cupressus lusitanica*. *P. radiata* has so far made outstanding growth, and promises well for the future. The site should be ploughed before planting, and lateral protection is a considerable aid to growth. Some undesirable growth forms have been observed, but these may be due to genetic factors. So far, *P. taeda* and *P. caribaea* have proved less promising, but *Cupressus lusitanica* has made excellent growth.

2986. PRIOR, K. W., WENDELKEN, W. J., and CUNNINGHAM, A. **The effects of the 1955–56 drought on exotic tree species in North Canterbury and the implication of these for site evaluation.** *N.Z. J. For.* 8 (1), 1959 (15–28). 4 refs.

Damage to exotic trees in N. Canterbury caused by severe drought during 1955–56 is reviewed, recognizing 5 grades, from slight foliage injury to death of trees. The species concerned [mainly conifers] are listed under 6 drought-damage categories; these in turn are related to site differences based on soil type, topography, rainfall, and other variables. It is shown that in many places in Canterbury a deficiency of soil moisture influences the growth and survival. Broad recommendations are made for assessing the potentialities of sites in the area, and emphasis is placed on the role hardwoods can play in afforestation on the drier sites. *From authors' summary.*

2987. **Regeneration experiments in Papua.** *Aust. Timb. J.* 25 (9), 1959 (41 . . . 56).

Describes a management programme begun by the Forest Service in 1954 for introducing *Tectona grandis*, *Cedrela odorata*, *Araucaria cunninghamii*, *Anisoptera* and *Swietenia* spp., *Khaya nyasica*, and 9 *Eucalyptus* spp., into 1800 acres of the virgin rain forest of the Brown River Area of Papua, whose hardwood capital has declined sharply, largely through the demands of Port Moresby. Trials on pilot plots gave disappointing results for 6 of the Eucalypts, rodent attack causing high and early mortality. The best progress was made by *T. grandis*, *E. torrelliana* and *E. deglupta*, which are held to be the most suitable for replanting the cut-out rain forest on the better soil types, though the best silvicultural techniques have not yet been determined.

2988. PARHAM, B. E. V. **Plant introduction in Western Samoa.** *SPC Quarterly Bulletin, Sydney* 9 (4), 1959 (44–7).

Includes short sections on Bamboos, hedges, forestry, and cover and shade trees. Species introduced and distributed by the Nafanua Agricultural Station near Apia include *Bambusa* and *Gigantochloa* spp., *Gmelina arborea*, *Terminalia richii*, *Cedrela odorata*, *Albizzia falcata*, *Swietenia macrophylla* and *Cassia siamea*.

2989. COTTLE, G. W. **Mahogany—a valuable tree for farmers.** *Agricultural Journal, Fiji* 29 (1), 1959 (19–20). O.R.E.

An account of *Swietenia macrophylla* in Fiji since its introduction in 1911. It is singularly free from pests and diseases, grows rapidly in the wet and intermediate zones, and yields valuable timber. It could also be of great value in avenues, or to provide shade and shelter for livestock. Financial returns are good, and some examples are discussed. *S. mahagoni* grows more slowly and does not lend itself to Fijian conditions.

### 232.12. Races and Provenance Trials

See also Nos. 2752–3, 2838, 3923.

2990. SIRÉN, G. Eräitä havaintoja keskisuomalaisen ja paikallisen mäntyrodun biologisista ja teknillisistä ominaisuuksista Perä-Pohjolassa. **[Biological and technical properties of the local and Central Finnish Pine provenances in North Finland.]** *Silva fenn.* 96 (1), 1959. pp. 32. 48 refs. [Fi.e.]

Observations of Scots Pine grown in N. Finland from seed from central Finland, indicate that when 20–35 years old it withstands damage by snow and blister rust as well as the local provenance. For the prevention of snow blight in young seedling stands, a 2–3% lime-sulphur spray in autumn, before the snow, proved most effective. No significant difference was found between the late-wood % of Central and N. Finnish provenances growing in adjacent stands in N. Finland, and such differences as were observed in increment and sp. gr. between provenances and between plantations and natural regeneration were possibly due to differences in age of stand or site qualities. It is suggested that the present usual limit of 200 km. for seed transfers should be extended to 300–400 km. at the same altitude, so that Central Finnish seed could provide regeneration material for the southern part of N. Finland.

2991. YÜ, H.-T. **[Studies on the germination [and seedling development] of various provenances of *Pinus massoniana*.]** *For. Sci., Peking* 1959 (6), (452–64). 18 refs. [Chin.chin.russ.]

Tests were carried out in Foochow, Fukien Province, on *Pinus massoniana* seeds from eight provinces of China: Szechwan, Kwantung, Kwangsi, Anhwei, Chekiang, Fukien, Hupeh and Hunan. Seeds from Chungsian (Hupeh) and Foochow (Fukien) were the best, having the highest 1000-seed-weight and germination. Those from Tung-hsi (Anhwei) and Kinhwa (Chekiang) were the worst; seeds from the other provinces were intermediate. Optimum temperatures for germination were found to vary between 28° and 19°C. Reduction in viability after storage for one year at Foochow was greater in seeds from the northern provinces than in those from the south. The growing season for the latter was almost two months longer. Plants grown from Kwantung and Kwangsi seed broke dormancy first, and formed Lammas shoots more frequently. Szechwan stock was the last to break dormancy, ca. one month after. The rates of growth of seedlings are compared and discussed, and the apparent desirability of using more southerly stock (Kwantung, Kwangsi) in afforestation in the Foochow area, rather than the local race of Pine, is discussed.

2992. WILLIAMS, R. D., and BEERS, T. W. **Seed source affects height growth of planted Jack Pine.** *Sta. Note Cent. St. For. Exp. Sta.* No. 137, 1959. pp. 2. 1 ref.

In 1952, seed of *Pinus banksiana* was collected from 16 natural stands in Michigan, Minnesota, and Wisconsin, grouped into northern (*a*) and southern (*b*) collection zones, and sown in Indiana, south of its natural range. The 2 + 0 seedlings were planted in 1954 in experimental blocks on mine banks and old fields, and 5 years later were measured. Trees grown from (*b*) seed had a mean height of 4·8 ft. vs. 4·2 ft. for (*a*), a statistically significant difference indicating that *P. banksiana* planted in S.W. Indiana should be from the more similar climatic zone (*b*).

2993. LITTLE, S., and TEPPER, H. B. **Six-year results from a Maryland planting of Loblolly Pines from different seed sources.** *Proc. 6th Ntheast. For. Tree Impr. Conf. 1958*, 1959 (26–9). 2 refs.

Briefly reports on a N.E. extension of the Southern Pine study [cf. *F.A.* 14 Nos. 3272–3; 18 No. 104] with 9 sources, including one local. Though most Southern provenances were somewhat taller when planted out as 1 + 0, their root systems had been injured, and they later suffered more from tip-moth and snow than the local race; this therefore appeared the best, despite a possibly greater growth potential in more southerly provenances.

2994. **Variation in *Pinus pinaster*.** *Extr. from Rep. For. Dep. W. Aust. 1958/59*, 1959 (31–2).

Assessment of provenance trials established in 1933 shows that up to the age of 26 years the Leiria (Portuguese) strain is significantly superior to the Landes, Corsican, and Esterel races in total height, volume to 4-in. d.u.b. and volume in the pruned 20-ft. stem section. Landes is superior to the Corsican race in height growth and both are superior to Esterel in all three points.

2995. CHING, K. K., and BEVER, D. **Provenance study of Douglas Fir in the Pacific Northwest region.**

**I. Nursery performance.** *Silvae Genet.* 9 (1), 1960 (11–7). 27 refs. [E.e.g.f.]

Douglas Fir seed from 14 sites on the west side of the Cascade Range in the Pacific Northwest (from lat. 42° 20′ to 49° 10′ N.) was collected in 1954 and 1956, and height, phenology and frost damage assessed for seedlings raised therefrom at the Oregon Forest Nursery in Corvallis. A preliminary analysis showed a distinct correlation between provenance and height growth in the second year after sowing. Seedlings of northern provenances generally grew well in height. There were significant differences in needle length between provenances, and these were somewhat correlated with seedling height. Flushing in seedlings of the most southern provenances was significantly earlier than in other provenances. One provenance of the most southern origin and 3 of the 4 northern provenances showed early terminal-bud formation. *From authors' summary.*

### 232.13. Trials of Hybrids and Other Products of Tree Breeding

See section 165 and Nos. 2974, 2980.

### 232.2. Preparatory Work. Auxiliary Measures

See also Nos. 2635, 2683, 2935, 3084, 3110–1, 3142–3, 3169–70, 3199.

2996. WIBECK, E. Norrländska skogsodlingsförsök. Redogörelse för Statens Skogsförsöksanstalts norrlandsavdelnings s.k. markberedningsytor. **[Artificial-regeneration trials in Norrland. The soil preparation plots of the Norrland Section of the State Forest Research Institute.]** The author, Stockholm. 1959. pp. 255 + 96 photos. Many refs. [Sw.]

Summarizes, briefly, data on the 107 series of trial plots for natural and artificial regeneration established from 1916 to 1933 by the predecessor of the present Research Intitute, including previously published results. Also describes in detail a group of 25 plots for studying methods of soil preparation before sowing, located on former Pine, Spruce, Pine/Spruce and sub-alpine Birch sites, discussing the early growth and present condition (stem numbers, volume, etc.) of the stands, now 35 to 40 years old. Chief conclusions are that burning benefited Pine but not Spruce, that soil cultivation (manual or by horsedrawn implements) was never economically justified and sometimes positively harmful (causing frost-heaving), and that Pine did better than Spruce on the poorer Spruce sites. One reason for this may have been infestation of Spruce by *Lophophacidium hyperboreum*, a fungus similar to, and possibly as dangerous as *Phacidium infestans* on Pine [cf. *F.A.* 10 No. 702].

2997. YLI-VAKKURI, P. Tutkimuksia ojitettujen turvemaiden kulotuksesta. **[The prescribed burning of drained bog as a silvicultural measure.]** *Acta for. fenn.* 67 (4), 1958 (1959). pp. 33. 44 refs. [Fi.g.*g*.]

Describes the effects of fire on plant cover, regeneration, etc. observed on 11 sites, mostly wet peat-bog with sphagnum moss and Pine [*räme*], drained between 1916 and 1953, clear-felled and burnt between 1941 and 1956. Only the slash, the aerial parts of the ground vegetation, and the loose litter were burned, and no peat fires were started. Most of the dwarf shrubs and other ground vegetation recovered quickly; indeed, regrowth from stumps of *Betula pubescens* was, if anything, more vigorous. Trial sowings of Pine gave 46% germination and survival on a dwarf-shrub/sphagnum plot and 16% on a dwarf-shrub/*Pleurozium schreberi*/*Hylocomium splendens* plot.

2998. MAŠATIN, I. M. Prostejšie sredstva mehanizacii lesovosstanovitel′nyh rabot. **[Simple ways of mechanizing regeneration work.]** *Lesn. Prom.* 1960 (1), (13–6). 1 ref. [Russ.]

Describes, with engineering drawings, an implement called a 'hedgehog' developed for scarifying clear-felled areas before direct sowing in Karelia [cf. *F.A.* 20 No.1700]. It consists essentially of a steel rod (50–80 kg.; 1·2–1·3 m. long) round which are welded 6 steel teeth (42 cm. long and 30–35 mm. in diam.) with sharpened points. Each tooth is supported by a strut. Three of these 'hedgehogs' are dragged along on a chain by a tractor. The rate of work is 3·5–3·6 ha. per [8-hr.] tractor shift, strips 70–100 cm. wide and 3–3·5 m. apart being scarified to a depth of ca. 15 cm.

2999. ČIRKIN, V. Prisposoblenie dlja podgotovki počvy. **[An implement for soil preparation [before planting].]** *Lesn. Prom.* 1960 (1), (16–7). [Russ.]

Describes and illustrates a tractor-drawn tillage implement consisting essentially of a triangular ploughing blade made of 20-mm. sheet steel fastened to the underside of a heavy metal drag. The rate of work is 7–8 ha./shift, when strips 1·5 m. wide are left between the furrows. The furrows themselves were 0·4–0·5 m. wide and 12–15 cm. deep. To prepare 1 ha. to the same degree by hand would take 10–12 man-days.

3000. SHANER, B. A. **Site preparation for reforestation, using a D-7 crawler tractor with angle dozer.** *J. For.* 57 (12), 1959 (915–6).

Concludes, from the scarification and furrowing of 160 acres of brush-covered land in Oregon at a mean cost of $11.50/acre, that use of the D-7 tractor with angle dozer is effective and economical. Seedlings planted in the furrows were free from competition for 2 years.

3001. REINECKE, [G.] Fräseneinsatz im Kiefern-Kulturbetrieb. **[The use of rotary cultivators in establishing Pine plantations.]** *Forst- u. Holzw.* 15(5), 1960 (89–92). 7 refs. [G.]

A review of 6 years' use of light and heavy rotary cultivators with 2- and 4-wheeled tractors in the Lüneburg area [cf. *F.A.* 17 No. 2693].

3002. MONJAUZE, A. Le reboisement sur rootage en plein et sur bourrelets. **[Reforestation on deep-ploughed ground and on ridges.]** *Rev. for. franç.* 12 (1), 1960 (1–25). 21 refs. [F.]

Traces from 1947 the history of the '*méthode steppique*' [cf. *F.A.* 20 No. 5401] in Algeria. Ridging was found to add greatly to the effect of sub-soiling with a 'rooter'. A horizontal blade attached to the tines of the rooter was capable of scarifying rough scrubland. Preliminary growth figures are cited for trees 3–8 years old (including Eucalypts, *Cupressus* and *Pinus* spp.) planted by this method in arboreta in Central Oran [cf. A. Monjauze in *F.A.* 16 No. 3964].

3003. Grelen, H. E. **Mechanical preparation of Pine planting sites in Florida sandhills.** *Weeds* 7 (2), 1959 (184–8). 3 refs. O.W.

Reports the second-year results of a study by the Southern Forest Experiment Station to compare various machines and methods used by private companies. The best method known at present of preparing sites on the W. Florida sandhills is by clearing with a heavy, tandem double-drum brush chopper. This machine, with drums set at counter-acting angles oblique to the line of pull, practically eliminates scrub Oak and wiregrass, while leaving the top soil and vegetable debris on the planting site.

### 232.3. Seed, Nursery Practice, Direct Sowing

#### 232.31. Seed

3004. Atay, I. Karaçam'ın (*Pinus nigra* var. *pallasiana*) tohumu üzerine araştırmalar. **[Research on the seeds of *P.n.* var. *caramanica*.]** *Istanbul Üniv. Orm. Fak. Derg. 9A* (1), 1959 (48–96). [Turk.e.*e*.]

Discusses in considerable detail the dates of cone ripening, cone dimensions and weights, cone types, cone treatment, seed dimensions and weights, testing seed quality, and variations in dimensions and quality with provenance. The salient data are given in the English summary.

#### 232.311. Seed Production (Seed Years, Seed Crops; Seed Orchards and Methods of Inducing Seed Production)

See also Nos. 2753, 2865–6, 2871.

3005. Yanagisawa, T., and Saito, M. **[Some examinations in Morioka Larch seed orchard.]** *Extr.* from *Ann. Rep. For. Exp. Sta., Hokkaido 1958*, 1959 (30–42). [Jap.e.*e*.]

Presents tabulated data on height, diameter, crown width, etc. of grafts with and without application of fertilizer, comparative height, weight, branch length, etc. of grafts and seedlings, and flowering of grafts.

3006. Steinbrenner, E. C., Duffield, J. W., and Campbell, R. K. **Increased cone production of young Douglas Fir following nitrogen and phosphorus fertilization.** *J. For.* 58 (2), 1960 (105–10). 15 refs.

In a statistically controlled experiment, $NH_4NO_3$ and superphosphate were broadcast in June or Sept. 1955 on twenty ¼-acre plots in a 20-year *Pseudotsuga taxifolia* stand in S.W. Washington. Dosages were 100 and 200 lb./acre of each fertilizer in 4 combinations, with an unfertilized control. This treatment was repeated on half of each plot in May 1956, and totally repeated in May 1957. Seeds from cones harvested in August 1956 weighed 1·2 lb./acre on (*a*) control plots, 4·5 lb. on (*b*) plots receiving 100 lb. of each nutrient, and 10·3 lb. on (*c*) plots receiving 200 lb. of each. In spring 1957, 37% of trees on (*a*), 56% on (*b*), and 75% on (*c*) produced flowers. The 1957 cone estimates (which were not analysed statistically) indicated little difference as between the dates when treatment was given in 1955, but some increase from the 1956 re-treatment. The great response in growth and cone production was shown to be attributable to the N applications, though increases occurred with an application of P in conjunction with the higher dosages of N.

#### 232.312. Seed Collection, Extraction and Grading (including Seed Weight)

See also Nos. 2750, 2766, 2878, 3075.

3007. Seal, D. T. **Collection of cones from standing trees.** *For. Rec. For. Comm., Lond.* No. 37, 1959. pp. 33. 4 refs.

Discusses the selection of seed-trees, and examines two methods of collecting cones, using (*a*) the 'tree bicycle' [see *F.A.* 9 No. 226], and (*b*) the tree-net [see *F.A.* 18 No. 3946]. Hints and instructions for the best use of both devices are given with detailed illustrations.

3008. Hagner, S., and Callin, G. Om insamling av tallkott. **[The collection of Pine cones.]** *Norrlands SkogsvFörb. Tidskr.* 1959 (4), (425–83). 2 refs. [Sw.sw.g.]

Factors affecting rates of picking from felled trees were studied in the winters of 1956–57, 1957–58, and 1958–59. Picking speed increased with increasing number of cones per crown, was higher for bare than for snow-covered ground, for young trees with cones concentrated in the top of the crown than for older trees, and for small than for large cones, and was not affected by trimming of the trees by the fellers. Time taken to move from tree to tree, for different stand densities and for bare and snow-covered ground, proved to be only a small proportion of the total picking time. Figures are given showing the varying distribution of cones between trees, for different mean values of cones per tree; e.g. with the unusually high mean of 400 cones per tree, 30% of the total cone production was concentrated on 10% of the trees and > 10% of the trees had few or no cones [cf. *F.A.* 20 No. 1707]. Tabulated data of working speeds in different conditions are given, and are considered a suitable basis for fixing piece rates. The use of a comb-type picking device (illustrated) increased speed of picking by 20–30% in favourable weather conditions, and this speed could be maintained in weather too cold for normal hand picking. Abolishing the minimum cone length of 30 mm. caused an increase of 12–15% in the amount of seed collected and of 9–24% in its unit price, whereas reducing it to 25 mm. caused increases of 11–14% and 7–18% respectively; further research on minimum cone length is needed. The use is recommended of mechanical equipment at the extraction centre to clean the cones of fragments of needles.

3009. Roe, E. I. **August-collected cones yield poor Red Pine seed.** *Tech. Note Lake St. For. Exp. Sta.* No. 575, 1960. pp. 2.

The seed was compared from cones of *Pinus resinosa* collected in (*a*) the third week in August and (*b*) mid-September. Figures for (*a*) were 8% empty seeds, 54% germination, and 10½ oz. clean seed per bushel of cones, vs. 0%, 85%, and 13½ oz. for (*b*). Mould contamination and the increased cost of opening green cones were further disadvantages of (*a*). Even (*b*) may have been too early, since in laboratory conditions 95% germination is expected. Cone maturity cannot be accurately foretold from the calendar, but if the majority of freshly picked cones from representative trees will float in kerosene, the cones are mature and should produce high-quality seed.

3010. **1. Pine cone drying rack. 2. Self-propelled elevating platform.** *FAO For. Equipm. Note* No. *A*.19.59, 1959. pp. 2.

(1) [See *F.A.* 19 No. 4073]; (2) This machine (Catchpole Engineering Co. Ltd., Bury St. Edmunds, Suffolk), specially built for thinning and picking fruit and seeds, can work on trees up to 22 ft. high.

3011. PROKAZINA, T. P. Novye dannye o nature lesnyh semjan. **[New data on the seed weight of forest trees and shrubs.]** *Lesn. Hoz.* 12 (2), 1959 (37–9). [Russ.]

Seed weights (in g./litre) were determined over a period of 2½ years for 61 species (1253 seed samples). The mean weights are tabulated for 37 species, and the maximum and minimum weights for 13 of them are shown, together with the seed sources.

3012. SCHELL, G. Die Abhängigkeit der Lebenskraft und der Pflanzengrösse von der Keimschnelligkeit bei unterschiedlicher Korngrösse. **[The effect of speed of germination in seeds of different size on general vigour [of Spruce seedlings].]** *Allg. Forst- u. Jagdztg.* 131 (2), 1960 (34–7). 11 refs. [G.g.]

Spruce seed of good quality was graded into 6 size classes and allowed to germinate. The germinated seeds (3366 in all) were then planted out in 7 groups according to their speed of germination (s.g.) measured by radicles emerging from the 7th to 21st day. S.g. and survival rate increased with seed size, and survival rate increased, independently of seed size, with s.g. Mean weight and height of plant after 1 and 3 years were correlated with seed size but not, independently of size, with s.g., except that the batches slowest to germinate were smaller and less heavy than the rest.

### 232.314. Seed Purchase, Trade and Transport (including Seed Certification and Legislation for this Purpose)

See also No. 2752.

3013. ROSSMÄSSLER. Die Behandlung der dem Gesetz über forstliches Saat- und Pflanzgut vom 25. September 1957 nicht unterliegenden Baumarten durch die Deutsche Kontrollvereinigung für forstliches Saat- und Pflanzgut e.V. **[The treatment of species not covered by the 1957 law on forest seed and planting stock, by the German Society for the quality control of forest seed and planting stock.]** *Allg. Forstzeitschr.* 15 (3), 1960 (32–4). [G.]

Gives the Society's directions [cf. *F.A.* 20 No. 4432] for 17 further species, including some exotics.

3014. VIKINGE, L.-A. Frö- och plantimportens omfattning under 1950-talet samt några synpunkter på frö- och plantförsörjningen. **[The extent of seed and plant imports in the 1950's and thoughts on seed and plant supply [in Sweden].]** *Svenska Skogsv-Fören. Tidskr.* 58 (1), 1960 (77–87). [Sw.]

Presents data on plant and seed imports by species and countries of origin. From 1952 to 1959, 387,657,000 plants (86% Spruce) and 109,625 kg. seed (15,907 Spruce, 6196 Pine, and 79,684 Oak and Beech) were imported. Control of provenance and quality is thought to be inadequate, and the need for a law on seed and plants is stressed.

### 232.315. Seed Storage and Treatment

See also Nos. 2879, 3026–7, 3029, 3031, 3072, 3074.

3015. MIČEV, B. Kolebanie vlagi v semenah vo vremja hranenija. **[Moisture fluctuations in seeds during storage.]** *Lesn. Hoz.*12 (1), 1959 (81–5). 4 refs. [Russ.]

At the Forest Seed Testing Station in Sofia, air-dry seeds and fruits of 38 tree and shrub species were kept for 1 year on open glass dishes in a room normally used as a seed store. Air temperature, r.h., and seed m.c. were measured during the year, and 5 periods of moisture loss or gain, related to changes in r.h., are distinguished and illustrated in a graph. Actual data are tabulated for m.c. changes in seeds of *Pinus sylvestris*, *P. nigra*, *P. peuce*, *Abies alba*, *Picea abies* and *Morus alba*, and in the winged seed of *Acer pseudoplatanus*, *A. platanoides*, *Fraxinus ornus*, and *F. americana*. For most of the species, germination % after storage was only slightly, if at all, worse than before.

3016. FILIMONOVA, V. D. Biologičeskie osnovy hranenija želudej v zimnij period. **[Biological bases for the winter storage of acorns [of *Quercus robur*].]** *Trud. Inst. Les.* No. 34, 1958 (83–132). 56 refs. [Russ.russ.]

Reviews methods of storage, and the morphology, anatomy and physiology of acorns with reference to storage, concluding that the best conditions are temperatures of 0° to − 2° C., high relative humidity, and good aeration. Experiments were made in (1) the dry steppe zone (Stalingrad region) and (2) the forest-steppe zone (Tambov region), on the storage of acorns in pits and trenches by Lotockij's method [see *F.A.* 16 No. 2890], in special storehouses and vegetable stores, in water, and in heaps in the forest under a covering of leaves. In (1) it is best to refrigerate the acorns at ca. 0° and r.h. ca. 100% until the winter cold sets in, and then to store them over winter in special storehouses in a layer of sand ≯ 40 cm. deep and of 9–10% moisture content. Best results in (2) were obtained in special refrigerated storehouses, though in this zone other methods also gave good results.

3017. ŞTEFĂNESCU, P. Cîteva observaţii asubra unor încercări de conservare a ghindei de stejar pe timp îndelungat. **[Some experiments in long-term storage of acorns.]** *Rev. Pădurilor* 74 (12), 1959 (700–3). 1 ref. [Rum.]

Experiment showed that 60–65% of acorns (*a*) [species not mentioned] germinate in 8–15 days in a sufficiently moist environment at 13–15° C., and in 25–30 days at 3–5°; 20–25% of acorns (*b*), on the other hand, need 45–60 days at 13–15°, and 80–110 days at 3–5°, in moist conditions before they germinate. If it is desired to store acorns from the autumn of one year to the following autumn, it is essential that they should be of type (*b*). Experiments showed that lots of (*a*) + (*b*) gave only 22–26% germination after 12 months whereas lots of (*b*) alone gave 60–70%. The only way of separating the two types, at present known, is to cover the acorns with a thin layer of soil or litter when they fall from the tree in autumn, and in the spring pick out type (*b*), which will then have radicles 3–8 cm. long, whereas (*a*) will have lignified radicles with a mean length of 15 cm. The selected acorns are then to be stored in a trench, preferably in a heavy soil, in the forest, on a N. aspect.

3018. MESSER, H. Über das Quellen und das Vorkeimen des Forstsamens. [**Swelling and pregermination of forest tree seed.**] *Forst- u. Holzw.* 15 (5), 1960 (93–5). 5 refs. [G.g.]

The ability of seeds to swell is the greater, the higher the temperature of the water used. At room temperature, soaking for 12 hr. is best for acorns, and Pine, Spruce and Larch seed. Warm-wet treatment should be used much more than at present with Pine, Spruce and Larch to accelerate germination. [Cf. *F.A.* 20 Nos. 4420–1.]

3019. ZENTSCH, W., and JAHNEL, H. Aussaatversuche mit stratifizierten Forstsaatgut im Staatlichen Forstwirtschaftsbetrieb Rövershagen. [**Tests with stratified seed at Rövershagen State forest estate.**] *Forst u. Jagd* 10 (2), 1960 (81–3). 3 refs. [G.]

A repetition of earlier tests [see *F.A.* 19 No. 4081] in slightly modified form confirmed results for Douglas Fir and Sitka Spruce. For Scots Pine, wet/cold pretreatment for 4 or 6 weeks greatly increased the germination % of inferior seed. No significant difference between treated or untreated seed was found for *Pinus nigra* and *Abies alba*.

3020. ZENTSCH, W. Untersuchungen zur Erhöhung des Keim- bezw. Pflanzenprozents bei der Tanne (*Abies pectinata*). [**Experiments to improve germination or plant percents in *A. alba*.**] *Forst u. Jagd* 10 (1), 1960 (36–8). 5 refs. [G.g.]

In trials with Polish seed having a germination %, when untreated, of 41 (1956) and 23 (1957), stratification in moist sand for 8–16 days at 2–5° C. increased germination %, though not greatly, and longer stratification had no significant effect. Removal of the germination-inhibiting turpentine by distillation in a vacuum of 4 mm. Hg at 30° or 40° C. for 3 or 6 hours with or without subsequent soaking in water for 18 hours, initially retarded germination but increased the germination % after 56 days, with best results (40·6 against 22·8% for controls) for 6 hours' treatment at 40° without soaking. Soaking in running water for 8–21 days had no effect, while wet or dry heating for 1–3 hours to 40° or 50° generally proved harmful, 3 hours' dry heat at 50° killing the seed.

3021. **Seed treatment to stimulate germination.** *Extr.* from *Rep. For. Dep. W. Aust. 1958/59*, 1959 (32).

A large-scale trial with imported Portuguese seed of *Pinus pinaster* showed that the most satisfactory treatment was soaking in water at room temperature for 80 days, followed by 7-weeks' stratification at 36° F., seed being dried before sowing. This significantly improved both the rate and % of germination.

3022. CHING, T. M. **Activation of germination in Douglas Fir seed by hydrogen peroxide.** *Plant Physiol.* 34 (5), 1959 (557–63). 29 refs. O.R.E.

Germination was stimulated by soaking seeds in 1% $H_2O_2$ for 36–48 hr. at room temperature. These seeds, and the seedlings from them, showed a marked increase in respiratory rate over water-soaked controls. Fresh seeds collected at a high elevation responded to $H_2O_2$ more dramatically than seeds collected from lower altitudes and subsequently stored at freezing temperature. Possible mechanisms of stimulation by $H_2O_2$ are discussed. *From author's summary.*

3023. BERGMAN, F. Försök att öka groningsenergin och grobarheten hos skogsfrö. [**Experiments to improve germinative energy and capacity of forest seed.**] *Svenska SkogsvFören. Tidskr.* 58 (1), 1960 (15–35). 24 refs. [Sw.sw.] (Also in *Årsberätt. Fören. Växtförädl. Skogsträd 1958.*)

Describes experiments at Sundmo with various treatments of conifer seeds. Soaking in water or weak acids for 24 hours raised the germinative energy (g.e.) of Scots Pine and Norway Spruce but not their germinative capacity (g.c.), and prolonged soaking of Pine seed in water was harmful at both room temperature and 2° C. Soaking of Pine seed in 0·5–1% $KNO_3$ increased both g.e. and g.c. and greatly increased the favourable effect of stratifying in melting ice, particularly for seed of low g.c., where a rise from 15% in controls to 45% (both after 20 days) was recorded. Stratification of Pine seed in coarse vermiculite gave similar g.c. increases to those given by equilibration in vermiculite in a moist air stream [cf. *F.A.* 21 No. 1687]. Blowing O gas through sand had no effect on seed stratified therein. Treatment with $KNO_3$ induced a certain amount of germination of Pine seed kept in the dark, but had no effect on Spruce seed, which germinated equally well in darkness or light. Stratification in coarse snow greatly increased g.e., plant %, and plant vigour in seed of *Larix sibirica*; with 4-year-old *L. occidentalis* seed, which had very low g.c., the plant % was more than trebled. Stratification in moist vermiculite greatly increased the plant % of *Abies lasiocarpa*. Pre-soaking in water or $KNO_3$ had no additional effect.

3024. FROMANTIN, S. Action des acides indole-β-acétique et 2,4,5-trichlorophenoxy-acétique sur la germination des grains de *Pinus pinea*, *P. silvestris*, *P. excelsa*, *Cupressus macrocarpa*, *C. sempervirens* var. *pyramidalis*, *Biota orientalis*, *Chamaecyparis lawsoniana*, *Tetraclinis articulata* et *Cryptomeria japonica*. [**The effect of IAA and 2,4,5-T on conifer**

**seeds [as above].]** *Phyton, Buenos Aires* 10 (2), 1958 (135–43). 5 refs. [F.f.span.] C.G.B.

The seeds were tested in Petri dishes on glass fibres with IAA or 2,4,5-T in molecular concentrations from $5{\cdot}7 \times 10^{-8}$ to $5{\cdot}7 \times 10^{-4}$ (0·001–100 and 0·014–144 mg./litre respectively). 2,4,5-T had no effect or a negative one on all species except *B. orientalis*. IAA had positive effects in some cases, at concentrations varying with species, and some negative effects. Germination % of *P. sylvestris* was significantly reduced by all concentrations. Considerable differences in response in an earlier, preliminary series suggest that the physiological state of the seed is of major importance. *P. pinea*, for instance, gave a positive response to both substances when the germination % of controls was 12, and very little or a negative response when it was 85. It is thought that treatments are likely to be ineffective or harmful for seed in good condition. [Cf. *F.A.* 19 No. 1896.]

3025. Cram, W. H., *et al.* **Seed technology.** *Extr.* from *Summ. Rep. Dom. For. Nursery Sta. Sask. 1959*, [1960] (10–1).

Moisture requirements of the stratifying media for Caragana seed were investigated, and results (tabulated) show that maximum germination followed stratification in media with 5–10% m.c. Viability of Elm seed was found to be inversely related to m.c. of the seed when harvested; mature seed, after 3 years' storage at 41°F., gave only 9% germination.

### 232.318. Seed Testing. Germination Tests. Seed Quality

See also Nos. 2991, 3012, 3075.

3026. Rohmeder, M. Güteuntersuchungen am Saatgut der *Abies grandis*. **[Quality testing of *A. grandis* seed.]** *Allg. Forstzeitschr.* 15 (8), 1960 (105–6). 3 refs. [G.]

Germinability of 71 batches tested (excluding obviously damaged batches) varied from 21 to 77% (mean 49). Empty seed averaged 32%. There was no difference between testing at a constant 25° C., or at temperatures varying between 20° and 25°. Cold/wet pre-treatment at 4° for 28 days often improved germination. Cutting tests invariably, and tetrazolium tests frequently, overestimated germinability.

3027. Pintarić, K. Uticaj starosti sjemena i djelovanje svjetla na proces klijanja kod sjemena pančičeve omorike (*Picea omorica* Panč.). **[The influence of age and light on the germination of *P. omorika* seed.]** *Rad. Poljoprivred.-Šum. Fak., Sarajevo* (*Šum.*) 2 (2), 1957 (89–104). 4 refs. [Croat.g.]

The viability of *P. omorika* seed of 1951–52, stored in a dark glass bottle hermetically sealed and kept at room temperature, decreased with increasing age of the seed, more sharply in 1954–55 than in 1953–54, and more in the dark than in the light. Germinative energy (g.e.) also decreased with increasing age, but older seeds showed greater g.e. in the dark than in the light. It is concluded that 14 days is long enough for testing germinative capacity of seed up to 2½ years old, and 7 days for determining g.e.

3028. Lotti, T. **Selecting sound acorns for planting bottomland hardwood sites.** *J. For.* 57 (12), 1959 (923).

Small-scale tests established that visual selection of acorns of *Quercus michauxii*, *Q. shumardii* and *Q. falcata* var. *pagodaefolia* produced at least 2–3 times the % of seedlings resulting from flotation tests.

3029. Ljubčenko, V. M. Osobennosti prorastanija stratificirovannyh semjan lipy i bereskleta. **[Features of the germination of stratified *Tilia cordata* and *Euonymus europaeus* seeds.]** *Lesn. Hoz.* 12 (3), 1959 (79). [Russ.]

The germination % and energy of *T. cordata* seeds (stratified for 35 days at 15° C. and 180 days at 0°) and of *E. europaeus* seeds (90 days at 15° and 100 days at 0°) was much greater when the seeds were germinated at 10–15° than at 20–25°.

### 232.32. Plant Rearing. Nursery Practice

See also Nos. 2935, 2970–1, 2982.

3030. Kingston, B., and Leuchars, D. **Nursery gadgets.** *Tech. Note For. Dep. Uganda* No. 81, 1959. pp. 4.

Describes and illustrates the design and use of three simple, 'home-made' devices: a root-pruner (piano-wire type), a pricking-out board, and transplant-bed clips for revetting boards.

3031. Vlase, I., and Iesan, T. Contribuţii la cultura bradului in pepiniera. **[Raising *Abies alba* in the nursery.]** *Rev. Pădurilor* 74 (12), 1959 (697–700). 3 refs. [Rum.]

Gives the results of studies on germination and storage of seed, seedbed density etc. and makes the following recommendations: (1) Sowing should be done in the spring, with seed having a germinative capacity of ca. 35%, which should give a plant % of 15·5. Seed should be stored at a m.c. of $\not>$ 30% in a temperature of 0–6° C. Losses of seedlings are high during the early summer months, and it is advisable to shade the beds for two months after germination, and to keep down weeds by hoeing or hand pulling.

### 232.321. Nursery Sites, including Factors affecting Selection of Sites for Nurseries

3032. Voce, B. Il dimensionamento dei vivai forestali. **[The dimensions of forest nurseries.]** *Monti e Boschi* 10 (12), 1959 (600–7). [It.f.e.]

Describes in detail, and illustrates by an actual example, an analytical method of calculating the size of a forest nursery: for each species to be raised, data are tabulated separately (*a*) for seed-bed, (*b*) for transplant bed, showing area sown or planted per year, number of years during which the area will be occupied, total area occupied, and initial and final numbers of seedlings and transplants (using an estimated coefficient of mortality).

### 232.322. Preparation and Treatment of Soil, including Maintenance of Fertility

See also Nos. 2846, 2852, 3267–8.

3033. BENZIAN, B. **Nutrition problems in forest nurseries**. *J. Sci. Food Agric.* 10 (12), 1959 (637–44). 8 refs. P.O.

Results from many small-plot experiments in different nurseries and seasons, with Sitka Spruce as the main test crop, have shown that it is safe to use commercial fertilizers (e.g. Nitro-Chalk, $(NH_4)_2SO_4$, superphosphate and $NH_4Cl$) in seedbeds and transplant beds. In short-term experiments, testing a range of composts and uncomposted organic materials, with and without additional fertilizer, effects were related to the major plant nutrients present. Interim results for two long-term rotation experiments, in which continuous conifer cropping was compared with that interrupted by fallow or green crops, have so far shown no benefit from the green crops. In the same experiments, averaging results of 8 seasons, seedlings grown with fertilizer were slightly taller than those grown with compost. A needle-tip burn, occurring every season in a heathland nursery on a highly leached, acid, sandy soil, proved to be due to Cu deficiency and was cured by a foliar application of Bordeaux mixture [cf. *F.A.* 18 No. 357]. In some older nurseries, often with soil of neutral or near neutral reaction, where Sitka Spruce and other conifers [*Pinus contorta*, *Tsuga heterophylla*, etc.] remain stunted even with ample manuring, good growth has been obtained after soil acidification, and after application of steam, formalin, and chloropicrin. [Results will be published in more detail elsewhere.] *From author's summary.*

3034. LAURIE, M. V. **The place of fertilisers in forestry**. *J. Sci. Food Agric.* 11 (1), 1960 (1–8). 28 refs. P.O.

A review, based mainly on European research, of their use in nurseries and established crops, methods of application, etc.

3035. SURBER, E., BRAUN, R., and PETER, E. Versuche zur Beschleunigung der Kompostbereitung. **[Experiments to speed up compost making.]** *Mitt. Schweiz. Anst. Forstl. Versuchsw.* 35 (6), 1959 (413–36 + 4 photos). 8 refs. [G.g.f.it.e.]

Describes composting trials with Beech leaves and coniferous slash, whole or comminuted, and various additions and treatments, with special reference to temperature fluctuations and aeration in the heaps. By turning over and breaking up the compost at appropriate times and adding urea, peat and urea, or partly treated town refuse, a satisfactory compost was obtained in 4–5 months. Additions of dried sewage sludge or Spruce sawdust were not satisfactory.

3036. TSUDA, K. **[Manure examination for *Larix*. (XI) Studies on the seasonal changes of the absorbed nutrients.]** *Extr.* from *Ann. Rep. For. Exp. Sta., Hokkaido 1958*, 1959 (67–74). 10 refs. [Jap. jap.e.*e*.]

[Cf. *F.A.* 20 No. 422.] Uptake of nutrients (N, P and K) was compared on plots with and without fertilizer treatment. N and P were taken up early in the growing season on the treated plot and slowly at all stages on the control. K was taken up earlier on the control than on the treated plot. *From author's summary.*

3037. **Nutrition trials on Jarrah seedlings**. *Extr.* from *Rep. For. Dep. W. Aust. 1958/59*, 1959 (29).

A pot trial to test the effect of various fertilizers on *Eucalyptus marginata* seedlings growing on laterite soil gave the following results: Heavy dressings of mixed inorganic fertilizers containing N proved toxic. Light dressings of NP and NPK produced vigorous plants but only 56% survival owing to scorching by the fertilizer. Best results were obtained with an enriched compost, which produced vigorous growth and 100% survival. Controls all survived but were $< \frac{1}{2}$ the height of plants receiving compost.

3038. DAVIDSON, H., and MCCALL, W. **Fertilizer studies on *Taxus***. *Quart. Bull. Mich. Agric. Exp. Sta.* 42 (2), 1959 (317–22). 6 refs.

Two-year-old plants of *Taxus cuspidata* were given NPK mineral fertilizers in different combinations and dosages. Recommendations based on results from this experiment are: (*a*) when applying an NPK fertilizer (e.g. 12/6/6), $\nless$ 1 lb. and $\ngtr$ 3 lb./100 sq. ft. should be used; (*b*) for top or side dressing with 33/0/0 or 0/0/60, < 1 lb./100 sq. ft. should be used; (*c*) Yew should be grown in soil with a soluble salt content $< 90$ mhos $\times 10^{-5}$. Death results at levels $> 155$ mhos $\times 10^{-5}$; (*d*) suggested levels of nutrition per acre are: $NO_3$ content 150 lb., P content 50, K content 125.

3039. SHOULDERS, E. **Caution needed in fall applications of nitrogen to nursery stock**. *Tree Plant. Notes* No. 38, 1960 (25–7). 2 refs.

Late-season fertilization of nursery beds with heavy application of N is sometimes recommended to improve field survival of Southern Pine seedlings. A study in 1956 and 1957 by the Southern Forest Experiment Station showed, however, that though the practice is helpful in some circumstances (e.g. when there is a known nutrient deficiency) it must be used with great caution, since it can sometimes reduce survival (especially of Longleaf Pine) and height growth.

3040. DAKEV, T. Redovo torene na semeništa ot čeren bor s mineralni torove. **[Row-fertilizing *Pinus nigra* var. *austriaca* seedlings with mineral fertilizers.]** *Gorsko Stopanstvo* 15 (1), 1959 (14–7). [Bulg.bulg.]

Gives data on height, diameter and weight of seedlings given 0, 4, 5·5, 7·5, 9·5 and 11·5 kg. granular $P_2O_5$/dekare. There was no advantage in rates > 5·5 kg./dekare.

3041. NEUBACHER, F. Eine neue, einfache und verlustlose Saatpflanzenaufzuchtsmethode für alle Baumarten. **[A new, simple and safe method of raising seedlings of all species.]** *Allg. Forstztg.* 70 (23/24), 1959 (277–9). 4 refs. [G.]

In this method, developed by the author, the plants are raised in a mixture of 1 part needle litter, specially prepared in slash heaps, and 2 parts decayed, crumbled-up stumps, preferably in trays. These can be kept indoors for pre-germination, raised on poles for protection against rodents, and transported easily to transplanting sites, particularly those at higher altitudes. [Cf. *F.A.* 20 Nos. 3090, 3093.]

3042. DIMITROV, P. Značenie na mikorizata za razvitieto na fidankite v razsadnika. **[Importance of mycorrhizae in raising nursery stock.]** *Gorsko Stopanstvo* 15 (4), 1959 (13–7). [Bulg.]

Compares height, root, and diameter growth of several conifers and broadleaved species grown with and without mycorrhizal fungi.

3043. FERREIRA DOS SANTOS DE AZEVEDO, N. Micorrizas de *Quercus suber* L. Parte II. Inoculação de viveiros de quercineas. **[Mycorrhizae of *Q. suber*. Part II. Inoculation of nursery plots of Oak.]** *Publ. Serv. Flor. Aqüic. Portugal* 24 (2), 1957 (183–220 + 4 plates). 70 refs. [Port.port.e.]

With the object of re-introducing native *Quercus suber* and *Q. faginea* into certain regions of Portugal, experimental nurseries were established for producing mycorrhizae-inoculated plants. Three successful inoculation methods were tried; the use of a soil inoculum proved the surest and the most economical. Young plants in inoculated plots developed much better than those in controls. Ectotrophic mycorrhizae of the types A, B, and Du, with saffron yellow, white, and black mantles, developed. In plants inoculated with pure cultures, only mycorrhizae with white mantles developed. [Cf. *F.A.* 14 No.164.] *From author's summary.*

### 232.323. Sowing and Covering

See also No. 3075.

3044. SWOFFORD, T. F. **A sowing rate computer for southern nurseries.** *J. For.* 58 (1), 1960 (43, 46).

The computer (illustrated) is a series of logarithmic scales of various sowing factors (desired density, germination %, purity of seed, expected survival, seeds per lb.) reproduced on circular dials of cardboard. Starting with the smallest dial, the factors are entered on successively larger dials, until the sowing rate is indicated by the arrow on the largest circular dial. The rate is given on one side by weight of seed per 100 ft. of bed 4 ft. wide, and on the other by number of seeds per sq. ft. The computer, though designed for Slash and Loblolly Pine, can be adapted to other species.

3045. RUMJANCEV, G. T. Zimnij posev sosny. **[Winter sowing of Pine seed.]** *Lesn. Hoz.* 12 (1), 1959 (62–3). [Russ.]

Pine [*Pinus sylvestris*] seeds (*a*) sown on 10 Dec. 1957 in the frozen soil of nursery beds (prepared in Oct.) in Leningrad Province, and covered to the normal depth with unfrozen soil, germinated 20 days earlier than (*b*) those sown conventionally in the spring. In Oct. 1958 mean lengths of the seedlings (plus roots) were (*a*) 26, and (*b*) 19 cm., and the mean weights of 100 seedlings were (*a*) 34 g. and (*b*) 12 g. Further trials will be made with other species.

### 232.324. Transplanting and Lining Out, including Grading of Seedlings

See also Nos. 3030, 3079–80.

3046. SCHUBERT, G. H., and LANQUIST, K. B. **Mist sprayer improves seedling harvester.** *Tree Plant. Notes* No. 38, 1959 (19–20).

The Shasta seedling harvester [cf. *F.A.* 15 No. 3492] has been improved by the addition of a mist sprayer which moistens the seedling roots on the conveyor without washing off the fine soil particles clinging to the fine roots.

3047. RUBŢOV, Ş. Încetarea vegetaţiei la puieţii forestiere şi epoca optimă de scoatere a acestora din pepiniere. **[The cessation of growth in tree seedlings, and the best time to lift them in the nursery.]** *Rev. Pădurilor* 74 (10), 1959 (578–83). 2 refs. [Rum.]

Gives tabulated data, derived from a Rumanian nursery at 90 m. alt., for 56 broadleaved deciduous species, indicating dates at which autumn coloration of the leaves begins, other signs of approaching dormancy, date of leaf-fall, and recommended dates for lifting.

3048. KATO, R. **[Growth of Larch seedlings (*Larix kaempferi* Sargent) based upon different densities when the methods of transplanting varied.]** *Extr.* from *Ann. Rep. For. Exp. Sta., Hokkaido 1958*, 1959 (17–29). 10 refs. [Jap.e.*e.*]

One-year seedlings were transplanted to nursery beds in May 1958 by different planting methods [(*a*) square, (*b*) strip, and (*c*) group planting] at densities of 32–128 seedlings/sq. m. for (*a*) and (*b*) and 64–256 for (*c*), and examined in late September. Results are tabulated. Mean diam. decreased significantly with increasing density, but was not affected by type of planting. Mean height was similar on all plots. Mean dry weight per seedling decreased with increasing density and was higher for (*b*) than for (*a*) or (*c*). Mean dry weight per sq. m. increased with increasing density. Densities of 36 seedlings per sq. m. are recommended.

### 232.325. Tending (in both Seedbeds and Transplant Beds)

3049. SCHNEIDER, E. O. **A progress report on simazine for controlling weeds in forest and nursery plantings.** *Proc. 13th Ntheast. Weed Control Conf.* 1959 (367–71). 5 refs. O.W.

A review of its properties and performance [all references are U.S.]. Most woody species show resistance to simazine applied either as a directed or over-all spray for pre-emergence control. The following species have been definitely established as tolerant: Apple (non-bearing), Balsam Fir, Barberry, Boxwood, Cotoneaster, Douglas Fir, Fraser Fir, Juniper, Norway Spruce, Privet, Red Pine, Red Spruce, Rose, Scots Pine, White Pine, Yew and White Spruce.

3050. OLBERG, R. Merkblatt über die chemische Unkrautbekämpfung im Forstpflanzgarten—Stand 1959. **[Chemical weed control in forest nurseries, [W. Germany] 1959.]** *Allg. Forstzeitschr.* 15 (8), 1960 (111–2). [G.]

Recommendations on the use of simazine (as wettable powder or in granulated form) in transplant beds, and of Alipur emulsion, a mixture of OMU (cyclo-octyldimethyl-urea) and BiPC (Butinol-(3-chlorophenyl) carbamate) in seedbeds, where simazine is too toxic, discussing dosages, application, duration of effectiveness, and susceptibility of weed species and forest plants, mainly on the basis of W. German experience. Alipur has so far proved suitable for Spruce, Pine and Douglas Fir, but not for Birch and Alder. Its effectiveness lasts only 6–8 weeks.

3051. Evrett, C. F., Malcolm, D. J., and MacGillivray, H. G. **Herbicide trials in conifer seedbeds and transplants**. *Proc. 12th Mtg. East. Sect. Nat. Weed Comm. Can.* 1958 (35–41). O.W.

(1) *Pre-sowing treatments.* In 1957 trials, $CaCN_2$ (880 and 1760 lb./acre), dinoseb amine (7·2 and 14·4 lb./acre), SES (3 and 6 lb./acre) and Na methyl dithiocarbamate [SMDC] (0·9 and 1·8 lb./acre), applied in July to beds to be sown in August, controlled all annual weeds, but also completely killed Black, Red and White Spruce and reduced Balsam Fir by 90%. In 1958 trials, dinoseb at 7·2 lb./acre gave excellent weed control; Balsam Fir, Red Spruce and Scots Pine germination was reduced by 20, 40 and 30% respectively when sown 14 days after treatment; Red Spruce sown 29 days after treatment was reduced by 30% and lacked vigour. All other species sown 21 and 29 days after treatment were unaffected. DMTT (255 lb./acre), SMDC (338 lb./acre) and MeBr (871 lb./acre), the last-named applied as a gas under a plastic cover, all gave good control with little adverse effect on species sown up to 21 days after treatment, except for a slight reduction in Balsam by MeBr applied 14 days before sowing, and in Spruce by DMTT applied 29 days before sowing. Flame sterilization of the soil, removed from the seedbed and replaced at depths of 2, 4, and 6 in., gave very good results. Mulching with sawdust proved unsatisfactory. (2) *Early pre-emergence treatments* were applied in July immediately after sowing of Red, Black and White Spruce and Balsam Fir. SMDC (392 and 784·1 lb./acre), EPTC (5 lb./acre), IPC + CIPC granular (1·2 lb./acre), all gave good weed control, but caused considerable injury to conifers. Of the following treatments applied in June, one day after the plots were sown, KCNO (25 and 50 lb./acre), CIPC + IPC (7 and 14 lb./acre), simazine (0·75 and 1·5 lb./acre), and neburon (0·75 and 1·5 lb./acre), the last named was the most successful, causing no damage to the conifers and, at the higher rate, controlling all weeds. Sterilizing by blow-torch gave good weed control, but damaged Red Spruce. (3) *Late pre-emergence treatments* were applied in July, 5 days after sowing. Simazine (3 and 6 lb./acre), Alanap (N-1-napthyl phthalamic acid) granular (4·8 and 9·6 lb./acre), diuron (0·75 and 1·5 lb./acre), dinoseb (3·6 and 7·2 lb./acre), 2,4,-D amine (2 and 4 lb./acre) all considerably damaged conifers. KCNO (13·5 and 27 lb./acre) affected neither conifers nor weeds. (4) *Post-emergence treatments*. The following either injured the conifers or gave unsatisfactory weed control: 2,4-D amine (1 lb./acre), SES (3 lb./acre), dalapon (5 lb./acre), Varsol [a white spirit] (50 gal./acre), IPC and CIPC (1·2 lb./acre), Alanap granular (4 lb./acre). (5) *Post-emergence treatments*: 3- and 4- year-old transplants were injured by diuron (75 lb./acre), 2,4-D amine (2 lb./acre), dalapon (5 lb./acre), and dinoseb amine (3 and 5 lb./acre) but by none of the other herbicides tried. Alanap granular (4 lb./acre) gave 50% control of cudweed [*Gnaphalium* sp.], and retarded spurry [*Spergula arvensis*]. CIPC + IPC (8 lb./acre) controlled both the above species, but one plantain species and remnants of sedge were not controlled. Simazine (1 lb./acre) gave 100% weed control.

3052. Taylorson, R., and Holm, L. **Weed control in coniferous nursery stock.** *Proc. 15th Ann. Nth. Cent. Weed Control Conf.* 1958 (125). O.W.

Herbicides applied in May to 2-year-old nursery transplants of Douglas Fir, Scots Pine, Austrian Pine, White Spruce, Blue Spruce and Multiflora Rose gave the following results by mid-July, expressed as % of weed reduction compared with controls (treatments in lb./acre): simazine (1,2, and 4) gave 89, 92 and 94%; diuron (½ and 1) 77 and 92%; dalapon (5) and EPTC (5 and 10) ⩽ 60%. Mixtures of simazine (1) with either dalapon or EPTC (5) gave 95%. Mixtures of diuron (½) with either 2,4-DES (4), dalapon (5), simazine (1) or EPTC (5) gave 90%; EPTC (5) mixed with dalapon (5), 93%. Superior weed control was maintained through September with the higher rates of simazine and the simazine/dalapon mixture. There was no injury to the conifers from any treatment, but Multiflora Rose became rather stunted where dalapon was used.

3053. Ahrens, J. F. **Chemical weed control in evergreen nurseries**. *Proc. 13th Ntheast. Weed Control Conf.* 1959 (397–400). O.W.

Two sets of experiments were carried out with various herbicides (1) on 3-year-old *Taxus* spp. that had been planted out for 1 year: treatments were made in April and again in June after clean cultivating and hoeing each time; (2) 2-year-old *Taxus* spp., *Tsuga canadensis* and *Pieris japonica* one week after planting out in May. In (1) some injury was caused by dinoseb (12 lb./acre), neburon (8 lb.), 2,4,5-TES (6 lb.), NPA (sodium) liquid (4 lb.), (but not by NPA granular), and simazine (4 lb.). No injury was caused by CIPC (8 and 12 lb.), 2,4-DES (3,4 and 6 lb.), simazine (2 lb.), CIPC granular (4 lb.) + 2,4-DES (4 lb.), neburon (4 lb.), CDEC granular (8 lb.) or CDAA (8 lb./acre). In (2) no injury was caused to *Taxus cuspidata* or *P. japonica* by any of the chemicals used. *T. capitata* was injured by all except CDEC, CDAA and NPA. Hemlock was injured by CIPC, 2,4-DES, CIPC + 2,4-DES, EPTC (ethyl-N, N-di-*n*-propylthiocarbamate), simazine and CDAA. In April dinoseb, simazine, neburon, NPA and CIPC + 2,4-DES gave fairly good control of chickweed [*Stellaria media*] and pineapple [*Matricaria matricarioides*]. When applied again on June 4th, good to excllent control of broadleaved weeds and grasses was obtained with all chemicals except 2,4-DES, NPA and CDAA. When applied in May, single treatments of 2,4-DES

(6 lb./acre) and NPA (4 lb.) gave good control for 4–5 weeks. EPTC, CDAA and CDEC were more effective after June applications than after April or May applications, but this may be due in part to residual effects of the April treatments. Simazine, neburon and 2,4,5-DES gave the longest residual effects. The 10% granular CIPC was more effective than the 5% formulation. CIPC (4 lb.) + 2,4-DES (4 lb.) was more effective than CIPC (8 lb.) or 2,4-DES (6 lb.).

3054. CHADWICK, L. C. **Controlling spring weed growth in *Taxus* by fall applications of herbicides.** *Proc. 15th Ann. Nth. Cent. Weed Control Conf.* 1958 (6–7). O.W.

Five herbicides or combinations of them were applied in Nov. 1957 to plots in a block of *Taxus cuspidata* var. *intermedia*. Ratings of weed growth were made in May and June 1958. Simazine at both 2 and 4 lb./acre gave excellent and lasting weed control. CIPC, 2,4-DES(SES) + CIPC, and 2,4-DES + monuron all gave satisfactory control throughout May, but weed growth was prevalent again by June. NPA proved unsatisfactory at the rates used.

3055. AHRENS, J. F. **Chemical weed control in Maple shade nurseries.** *Proc. 13th Ntheast. Weed Control Conf.* 1959 (413–5). O.W.

Effective control of dense growth of broadleaved and grass weeds was obtained with 2·5 or 5 lb./acre amitrol applied in May and again in June. The best residual effects in pre-emergence treatments were obtained with diuron (3 or 6 lb./acre) or simazine (4 lb./acre). Great possibilities are envisaged for the use of amitrol plus a residual herbicide to eliminate subsequent hoeing. No trees were injured.

### 232.327. Protection Measures in Nurseries

See also Nos. 3259, 3348–9, 3408, 3443.

3056. ALDHOUS, J. R. **Control of cutworm in forest nurseries.** *Forestry* 32 (2), 1959 (155–65 + 3 photos). 17 refs.

Larvae of *Agrotis segetum* (cutworms) damaged seedlings on a light loam soil at Kennington Nursery, Oxford. Experiments (1955–7) investigated the effect of BHC, DDT, aldrin, and dieldrin on cutworms and their phytotoxicity to Sitka Spruce seedlings. A spray containing 3 lb. aldrin/acre (as a 30% miscible oil) or 1½ lb. dieldrin/acre (as a 15% miscible oil) gave excellent control of *A. segetum* larvae and did no damage to the seedling crop. Both insecticides were applied in 100 gal. water/acre. Immediate control of cutworm was obtained with applications at time of expected larval emergence (mid-June) or at time of first visible crop damage (mid-July); applications one month later gave good control after 3 days. Stock beds containing seedlings of all the conifers commonly used in Britain have been sprayed in mid-July with aldrin and dieldrin at half the rate used in the experiments. No species was damaged and control of cutworm was good. *From author's summary.*

### 232.328. Vegetative Propagation

See also Nos. 2764, 2766.

3057. FILHO, O. A. GURGEL. A propagação vegetativa de espécies florestais (I). **[Vegetative propagation of forest species (I).]** *Rev. Agric., Piracicaba* 34 (1), 1959 (11–30 + 2 tbls.). 23 refs. [Port.port.] A.P.B.

Presents some preliminary results of work at the Hôrto Experimental de Santa Rita do Passa Quatro, São Paulo, in the propagation of *Piptadenia peregrina*, *Stryphnodendron adstringens*, *Pterodon pubescens*, *Hymenaea stilbocarpa*, *Copaifera langsdorffii*, various *Eucalyptus* spp., and *Pinus elliottii*. In general, budding was more successful than grafting, especially when carried out in August or October. Layering was particularly successful with *C. langsdorffii* and *P. elliottii*. Experiments with cuttings gave no positive results.

3058. FILHO, O. A. GURGEL. A propagação vegetativa de espécies florestais (II). **[Vegetative propagation of forest species (II).]** *Rev. Agric., Piracicaba* 34 (2), 1959 (119–30). 18 refs. [Port. port.] A.P.B.

Presents the results of grafting and budding experiments with *Pterogyne nitens*, *Centrolobium tomentosum*, *Myroxylon peruiferum*, *Melia azedarach*, *Caesalpinia ferrea*, *Balfourodendron riedelianum*, *Platycyamus regnellii* and *Araucaria angustifolia*. Three methods were used: (1) Whip and tongue grafting, (2) saddle grafting, and (3) budding, and grafts were made at monthly intervals throughout the year. Method (3) was suitable for all the species studied except *A. angustifolia* and was possible throughout the year; (1) was successful chiefly from October onwards, but gave a lower % of successes than (3); (2) was successful with *A. angustifolia*. In general, best results were obtained under glass, with controlled light and humidity.

3059. CABANDAY, A. C. **Propagation of Kauayan-tinik (*Bambusa blumeana* Schultz) by various methods of cutting and layerage.** *Philipp. J. For.* 13 (1/2), 1957 (1959), (81–97 + 2 plates). 8 refs.

Describes vegetative propagation experiments at the Bambusetum, Makiling National Park, Laguna under field conditions. The methods used (illustrated), with survival % after 6 months and estimated labour costs for the establishment of a 1-ha. plantation were: (1) unsplit cuttings 60·8% and Pesos 32·05; (2) split cuttings 59·7% and Pesos 24·88; (3) ground layering 27·7% and Pesos 74·09; (4) air layering 69·9% and Pesos 57·29. Improved techniques may reduce labour costs for (4), which had the best survival record.

3060. NAGANO, S. **[On the vegetative propagation of Pine. Effects of certain propagating media on rooting responses and root system of cuttings.]** *J. Fac. Agric. Iwate Univ.* 4 (3), 1959 (267–75). 17 refs. [Jap.e.*e*.] O.R.E.

Cuttings taken from 2-year-old seedlings of *Pinus thunbergii* were grown in 10 different media. Rooting % was best in black volcanic soil, followed by loam, loam/sand, vermiculite, etc. The number of adventitious roots was greatest in pumice dust, followed by Kanuma soil, black volcanic soil, loam, etc. Root length was greatest in sand, followed by vermiculite/sand, black volcanic soil, loam/sand, etc.

3061. Urquijo Landaluze, P. Las auxinas de enraizamiento en la multiplicación vegetativa del castaño. **[Growth regulators assisting root formation in the vegetative propagation of Chestnut.]** In *National Reports, World Congress of Agricultural Research, Rome 1959* (*Espagne*) 1959. pp. 9. [Span.span.f.g.e.it.] E.M.B.

Reports on tests carried out since 1944 with various clones, mostly hybrids [species not stated] [cf. *F.A.* 15 No. 232; 17 Nos. 1516, 1518–9]. Continued tests largely confirmed the earlier results, with best rooting and survival from a combination of NAA, IBA (0·5%) and 2,4-D (0·07). In small-scale trials, a phenoxy-acetic acid proved promising. Variation between clones was considerable, and exceeded that between growth regulators and treatment dates. All hybrids were more difficult to root than *Castanea sativa*. Preliminary trials with mist propagation of cuttings treated with growth regulators were promising, but none of the rooted cuttings survived [cf. *F.A.* 18 No. 2769].

3062. Šamsiev, K. Vlijanie diametra čerenkov na priživaemost′ i rost sažencev topolej. **[The influence of the diameter of Poplar cuttings on survival and growth.]** *Lesn. Hoz.* 12 (2), 1959 (69–70). [Russ.]

In the Tashkent region and in the Fergana Valley, cuttings 15–35 cm. long and 0·5, 1 or 1·5 cm. in diameter of (*a*) *Populus alba* var. *bolleana*, (*b*) *P.* × '*canadensis*', and (*c*) *P. nigra* var. *italica* were planted in trial plots. Tabulated data are given on rooting %, and on height and diameter growth in the first year or two after planting. With (*a*) only the two larger diameters gave good results; with (*b*) and (*c*), all sizes of cutting did well, though the larger ones were slightly superior.

3063. Joachim, H.-F. Über unterschiedliches Anwachsen von Pappelstecklingen in Pflanzenzuchtgärten. **[Differences in rooting and growth between Poplar cuttings in nurseries.]** *Forst u. Jagd* 10 (2), 1960 (57–61). 4 refs. [G.]

In pot tests with *Populus* × *robusta*, cuttings with visible buds developed earlier and frequently better shoots, and a better root system than those without (taken from the lower part of the stool shoot, where lateral shoots—removed in making the cuttings—had developed from the buds), though the latter started root development somewhat earlier. Where more than one shoot had developed from the cambium of the upper cut of 'budless' cuttings, abnormal leaf shapes occurred. Observations on the effect of the weather, soil preparation, and the differences in rooting behaviour of different cultivars are also briefly discussed.

3064. Vaškulat, P. N. O različnoj regenerativnoj sposobnosti kornej u odnogo i togo že dereva. **[Differences in capacity for root regeneration of roots of the same tree.]** *Bot. Ž.* 44 (11), 1959 (1666–73). 11 refs. [Russ.]

Reports work done in 1953–55 [cf. *F.A.* 16 No. 4024], using root cuttings 5 cm. long taken from (*a*) the tap-root, (*b*) one 1st-, and (*c*) one 2nd-order root of each of several 12- to 14-year-old nursery-grown plants of *Phellodendron amurense*. The mean diameter of the cuttings was (*a*) 1·6, (*b*) 1·2, and (*c*) 1·0 cm. The roots were cut in autumn (heeled in for the winter) and also in spring. Formation of callus, shoots, and roots was observed. The results (graphed) showed that root cuttings taken from (*a*) survived better than those from (*b*) and especially than those from (*c*). Taking rooting of (*a*) as 100, (*b*) was 81 and (*c*) only 67%. Cuttings of (*a*) taken from the region nearest to the root collar had the best rooting capacity, this capacity decreasing with increasing distance from the root collar. In cuttings from (*b*) this trend was less obvious, and in (*c*) was almost absent, though the end portions of (*c*) did give significantly lower rooting. Sometimes adjacent cuttings differed sharply in rooting capacity, and further study is needed to explain this.

2065. Næss-Schmidt, K., and Søegaard, B. Podehøjdens indflydelse på podekvistens vækstrytme og form. **[The effect of grafting height on the growth rhythm and form of the scion.]** *Forstl. Forsøgsv. Danm.* 26 (2), 1960 (313–24). [Dan.e.*e*.]

In 1951, experiments were begun by the Østsjællandske Skoves Træforædling on field grafting on selected stocks of a variety of species in young plantations. In the first two years, when side veneer grafts were made on small plants ('low grafting') as is usual in nursery grafting, results were poor, with only 17% successful. With a new technique, 'high grafting' on to 6- to 7-year stocks, successes increased to 80%. In this method the two whorls next below the union were reduced so that they should not interfere with the initial growth of the scion, and 3–4 living whorls were left untouched below them. The two methods were compared, using scions of the same clone of Douglas Fir, and development was studied over 6 years. With 'high grafting', mean leader length increased steadily through the period, the axis remained vertical, and branching was normal for the clone; with 'low grafting', mean leader length varied erratically from year to year and was generally low, the axis deviated from the vertical, and there was a pronounced tendency to side branching.

3066. Braun, H. J. Die normalen Verwachsungsvorgänge nach Pfropfung von Laubbäumen. I. Das Verfahren des seitlichen Einspitzens. **[The normal process of union after grafting of broadleaved trees. I. Side grafting.]** *Zeitschrift für Botanik, Stuttgart* 46, 1958 (309–38). 17 refs. [G.g.] O.B.D.

Grafts were made on 1- to 4-year-old Poplars by the method of inserting the sharpened end of the scion beneath the bark of the rootstock, and the process of union was followed in detail. Three stages are distinguished: (1) an abscission layer is formed and preliminary tissues laid down joining the scion and rootstock; (2) in the course of growth of the intermediate tissue and of the shoot axis of the rootstock, a change occurs in the relative positions of rootstock and scion that produces a more favourable point of departure for future growth; (3) after the disappearance of the abscission layer and the formation of parenchyma bridging scion and rootstock, the cambium of both unites and tissue is laid down in the normal way. (2) is considered to be the vital phase in making a successful graft.

3067. Holzer, K. Zirbenpropfungen. [**Grafting *Pinus cembra*.**] *Allg. Forstztg.* 70 (3/4), 1960 (35–7). 8 refs. [G.]

Exploratory trials (in the greenhouse, near Vienna) with scions from 9 trees, using *P. cembra*, *P. nigra*, *P. montana*, *P. sylvestris* and *P. strobus* as stocks, resulted in many successful unions. Second-year survivals ranged from 93% on *P. cembra* to 60 on *P. strobus*, and growth was generally satisfactory. Grafts in the open on *P. sylvestris* failed.

3068. Gambi, G. Promettente risultato dell' innesto del '*Populus tremula*' L. su '*Populus alba*' L. [**Promising results from the grafting of *P. tremula* on to *P. alba*.**] *Monti e Boschi* 10 (12), 1959 (623–7). 3 refs. [It.f.e.]

On 31 March 1959, *P. tremula* scions were grafted on to 39 one-year rooted cuttings of *P. alba*. By 3 July, 26 of the grafts had taken, with a mean scion shoot length of 1·2 m. Crown grafts were more successful than slit grafts.

### 232.329. Miscellaneous (including Greenhouses, Frames, Raising in Pots, Tubes etc.)

See also No. 3773.

3069. Kraus, J. F., and Johansen, R. W. **A test of gibberellic acid on Longleaf Pine.** *J. For.* 58 (3), 1960 (194). 1 ref.

Tests on the response of *Pinus palustris* to a 200 p.p.m. solution of gibberellic acid at the Lake City Research Centre in March 1957 gave negative results. Treatments, with 60 seedlings in each, were: dipping the entire plant; dipping the root system only; dipping the foliage to the root collar; and an untreated control. Four months after planting, survivals were 45, 62, 68, and 88% respectively. The differences were significant at the 1% level of probability. Untreated controls looked the most vigorous. [Cf. *F.A.* 20 No. 4146.]

3070. Bilan, M. V., and Kemp, A. K. **Effect of gibberellin on height growth of one-year old seedlings of Loblolly Pine.** *J. For.* 58 (1), 1960 (35–7). 7 refs.

Twenty-four bundles of five 1-year-old seedlings of *Pinus taeda* were treated with 1, 2, or 3% aqueous solutions of gibberellin. Roots (*a*), shoots (*b*), or entire seedlings (*c*) were soaked in a solution for 4 or 8 hours. No significant difference was found between height increment of 4- and 8-hour treated seedlings. Each of the 3 concentrations used increased height growth of (*a*) and (*c*), the increase being proportional to the higher concentration of gibberellin; (*b*) responded only to the highest concentration. Mean height growth of seedlings for the respective concentrations was 46 cm., 49 cm., and 56 cm., vs. 37 cm. for controls. As the concentration of gibberellin increased, the number and length of lateral branches decreased, and needles became lighter in colour and tended to show a more pronounced alignment with the longitudinal axis of the stem. [Cf. *F.A.* 20 No. 4146.]

3071. Hotjanovič, A. V., and Bajdalina, N. A. Dejstvie gibberellinovoj kisloty na rost i anatomo-fiziologičeskie osobennosti u nekotoryh drevesnyh rastenij. [**The effect of gibberellic acid on the growth and anatomical and physiological features of some woody plants.**] *Dokl. Akad. Nauk SSSR* 128 (5), 1959 (1084–7). 14 refs. [Russ.] A.P.B. (Also in *Lesn. Hoz.* 12 (7), 1959 (32–5). [Russ.])

Young plants were treated seven times at intervals of 4 days with solutions of 100 and 200 mg. gibberellic acid per litre, applied either as a spray (on *Quercus robur*, *Pinus sylvestris*, *Phellodendron amurense*) or as one drop (0·03 ml.) on the terminal bud (on *Populus tristis*, *P.* × 'Leningrad', *Acer platanoides*, *Catalpa* sp.). *P.* × 'Leningrad' was the first to respond to the treatment, but after a month the effect of the acid (compared with untreated controls) was more noticeable on the naturally slower-growing *P. tristis*. In the Poplars, the number of nodes and leaves remained the same as in controls, but the internodes were longer, and secondary wood had thinner cell-walls and wider lumina in the libriform fibres and in the vessels. Treated plants of *P. tristis* were found to have a higher content of sugars in the leaves. In *P.* × 'Leningrad' and *Ph. amurense*, the moisture content of treated was higher than that of untreated plants. The dry weight of the aerial parts of *Ph. amurense* was virtually the same as in the controls, but that of the root system was significantly less. Changes of leaf form were noted with most species. A break of dormancy was obtained in Aug./Sept. with some of the species. Oak formed Lammas shoots, but Pine did not respond to the treatment.

3072. Ch'ien, P.-L., and Chang, C.-T. [**Experimental treatment of seeds and planting stock with *Gibberella fujikuroi*.**] *For. Sci., Peking* 1959 (2), (123–9). [Chin.russ.]

Reports on the greater germinative energy of seeds of numerous species (e.g. *Pinus* spp., *Ailanthus* sp., *Fraxinus* sp., *Robinia pseudoacacia*, etc.) when soaked in hot water (45–100° C.) and then in a diluted extract of *G. fujikuroi*, for $\nless$ 24 hours, under both laboratory and glasshouse conditions. After germination, seedlings from 3 to 7 days old were soaked in the extract and, after planting in a warm room, sprayed with the extract every 2–3 days. [Total duration not given.] This gave from 14 to 20% greater height increment.

### 232.33. Formation of Stands by Direct Sowing

See also Nos. 2935, 2997, 3110, 3116, 3170.

3073. Lawrence, W. H., and Rediske, J. H. **Radio-tracer technique for determining the fate of broadcast Douglas Fir seed.** *Proc. Soc. Amer. For. 1959*, 1960 (99–101). 21 refs.

Describes a technique using scandium 46, a strong $\gamma$-ray emitter, which makes it possible to detect buried seeds. With an initial activity of $3\mu c$/seed, maximum limit of detection of twice background value, with a portable NaI crystal scintillator, was 32 in. in air and 18 in. through porous soil. In a field test with 440 labelled Douglas Fir seeds, most were readily located with the scintillator during the field germination period of 5 months, though weathering removed up to 25% of the tracer. Even fragments of destroyed seed were located and recovered from insect and rodent burrows, 95% of all seeds being accounted for. This technique provides a reliable means of obtaining quantitative data on causes of seed destruction.

3074. ENGLE, L. G., and CLARK, F. B. **New rodent repellents fail to work on acorns and walnuts.** *Sta. Note Cent. St. For. Exp. Sta.* No. 138, 1959. pp. 2. 3 refs. (Also in *Sth. Lumberm.* 199 (2489), 1959 (108).)

Oak and Black Walnut seed (2700 in all, sown in a ½-acre opening in an Oak/Hickory stand in spring and autumn of 1958 and spring 1959) coated with endrin or thiram produced rather fewer seedlings than untreated controls. The much higher plant % in 1958 than in 1959 could be correlated with the good Hickory mast crop of 1957 which produced a diversionary supply of food for rodents. It is suggested that the results of direct sowing of Oak and Walnut might be improved by sowing stratified seed in the spring following a good mast year.

3075. VOLKOV, F. I. K obosnovaniju nekotoryh priemov poseva želudej. **[The bases of some methods of sowing acorns.]** *Trud. Inst. Les.* No. 38, 1958 (51–8). 10 refs. [Russ.russ.]

Describes a method of measuring the force exerted by the shoot of a germinating acorn, based on the principle of measuring the distance through which the growing shoot can raise a small, spring-loaded glass. With large acorns, the force averaged 17·43 g., and with small ones 8·97 g./shoot. From these and other experiments it is concluded that the force of the shoot is in proportion to acorn weight, and that if large and medium-sized acorns are planted 7–8 cm. deep, small ones should be planted at 3·5-4 cm. Trials were made at Dzhanybek (Cis-Caspian lowland) with acorns from the Moscow region: the smaller acorns (planted at 5 cm.) had a lower germination and survival % but their seedlings approached in size those from the larger and medium-sized acorns (sown 8 cm. deep). Division of acorns into large and small fractions and planting the latter ca. half as deep as the former is recommended.

3076. KARANDINA, S. N., and POL′SKIJ, M. N. Opytnye posevy duba na temnocvetnyh počvah bol′ših padin v severo-zapadnoj časti Prikaspijskoj nizmennosti. **[Trial sowings of Oak on the dark soils of the great depressions in the N.W. part of the Cis-Caspian lowland.]** *Trud. Inst. Les.* No. 38, 1958 (41–50). [Russ.]

Tabulates the mean height and diameter of Oak seedlings from 1951 to 1954, on plots sown by five different methods. The best methods were: line sowing with 3–5 acorns per seed-spot and 50 cm. between seed-spots; nest sowing with 3 seed-spots per nest; and line sowing with acorns 15–20 cm. apart. Sowing depths of 8–9 cm. proved satisfactory.

3077. LISENKOV, A. F. Vlagoobespečennost′ duba v kul′turah različnoj gustoty i različnyh sposobov poseva. **[Moisture supply of Oak in plantations of different density and [established by] different methods of [direct] sowing.]** *Soobšč. Inst. Les.* No. 12, 1959 (84–91). 5 refs. [Russ.russ.]

Direct sowings of Oak were made with 1, 3, 6–7, 10–11 and 20–25 acorns per seed-spot [cf. *F.A.* 19 No. 3950], and also singly, 11 or 60 cm. apart in rows. Some results are given of microclimatic investigations, particularly on soil moisture supplies. These show that, under the steppe conditions of the S.E. Ukraine, it is best to sow 4–5 pregerminated acorns per seed-spot.

### 232.4. Formation of Stands by Planting

See also Nos. 2952, 2954, 2966, 2969–71, 2982, 3162.

3078. STREHLKE, E. G. Kostensenkung durch billigere Kulturen. **[Reducing costs by cheaper plantation establishment.]** *Forst- u. Holzw.* 15 (4), 1960 (61–4). 4 refs. [G.]

Discusses savings possible in time and money by careful choice of planting method, planting stock, spacing, mixtures and protection, and organization of work, with special reference to W. Germany.

### 232.41. Planting Stock (Type, Handling and Treatment)

See also Nos. 2683, 3013–4, 3445, 3478.

3079. HEDEMANN-GADE, E. Ett försök med treårig omskolad gran. **[A study of 3-year-old Spruce transplants.]** *Skogen* 47 (4), 1960 (72–3). [Sw.sw.]

Plants from seed sown in 1956 were lined out at 1 or 2 years old and were examined for their suitability as 2 + 1 or 1 + 2 planting stock in 1959. The 1 + 2 plants varied in height from 9 to 37 cm. (mean 21·7), whereas the 2 + 1 plants showed a much narrower height range but had a mean height of only 12·1 cm. Photographs of typical plants show, however, that the root systems of the 1 + 2 plants were much less compact and less suitable for planting out. Further research on 3-year-old and 1 + 1 transplants is needed. When transplants < 4 years old are used, it is essential to keep down grass on the planting sites in the early years.

3080. SHIPMAN, R. D. **Survival and growth of graded Longleaf Pine nursery stock.** *J. For.* 58 (1), 1960 (38–9, 42). 6 refs.

Seedlings of *Pinus palustris* totalling 2400 were divided into two grades by stem size and general appearance and planted in plots on Carolina-Georgia sandhills. Best survival (66–76%) resulted from planting grade-1 seedlings on sand or sandy loam, regardless of date in the dormant season. Since grade 2 failed on sand or when planted late, most effective use of stock was to plant both grades on sandy loam in mid-dormant season. On average, grade-1 seedlings maintained a 1·9 ft.

height advantage over grade 2; after 5 growing seasons 40% of grade 1 were $\geqslant$ 7 ft. high vs. 16% for grade 2. Clipping foliage had little or no effect on survival.

3081. JACALNE, D. V., MEIMBAN, J. R., JR. and TADLE, J. F. **A study on the stump planting of Mahogany (*Swietenia macrophylla* King).** *Philipp. J. For.* 13 (1/2), 1957 (1959), (63–80 + 2 photos). 7 refs.

In an exploratory experiment, batches of 50 or 100 stumps in 1-cm. and 1·5-cm. diam. classes were planted at Los Baños, Laguna, along with similar classes of whole seedlings from the same stock. Stumps sprouted 2–41 days after planting, and survival was better for plantings at the beginning or middle of the rainy season than at the end. Growth for the first 4 months was 11·7–17·2 cm. vs. 2·7–4·2 cm. for seedlings; but over a 2-year period seedlings showed greater annual increment, and their range of survival (36–70% vs. 5–57% for stumps) suggested their superiority as planting stock. Stumps of 1 cm. diameter gave a higher mean increment and % of sprouting and survival than stumps of 1·5 cm. Suggestions are made for further tests.

3082. HEDEMANN-GADE, E. Plantrötters känslighet för belysning. **[Sensitivity of roots of nursery plants to insolation.]** *Skogen* 47 (5), 1960 (105). [Sw.]

Two previous studies [see *F.A.* 10 No. 1028; 19 No. 4141] are summarized. Results of an experiment in 1958 with 2 + 0 Spruce and 1 + 0 Pine included the following: (1) 2 + 0 Spruce lifted on 14 May, while still dormant, were resistant to at least one hour's exposure, whereas mortality of those lifted on 14 June after growth had started, was 20% by autumn 1959; (2) 1 + 0 Pine proved very susceptible, with mortalities of 20 and 100% by autumn 1959, for plants lifted in May and June respectively and exposed for 15 min. Early lifting, storage in a cold chamber, and avoidance of exposure are recommended, especially for 1 + 0 plants.

### 232.42. Methods of Planting (including Use of Fertilizers etc.)

See also No. 2935.

3083. KUROVSKIJ, V. F. Posadka sosny v glubokie borozdy. **[Planting Pine in deep furrows.]** *Lesn. Hoz.* 12 (2), 1959 (71–2). [Russ.]

Preliminary results of planting Pine in furrows $\nless$ 35–40 cm. deep (and 1·5–2 m. apart) in the Ukraine are good. Conventional planting gives poor results because of chafer [*Melolontha* sp.?] damage.

3084. MERZ, R. W., and FUNK, D. J. **Preplanting ground treatment tests for White Pine in south-eastern Ohio.** *Tech. Pap. Cent. St. For. Exp. Sta.* No. 167, 1959. pp. 8. 3 refs.

In a study on a typical old field in S.E. Ohio, *Pinus strobus* seedlings were planted on the ridges of double furrows, in single furrows, in lines ripped to a max. depth of 28 in., in 2-ft.-square scalps, and without previous site preparation. Planting for each treatment was by (*a*) bar, (*b*) mattock, or (*c*) machine. Ground preparation increased costs from 20 to 90%, scalping being the most expensive method; (*a*) and (*b*) cost 20–50% more than (*c*), but (*a*) was cheaper than (*b*). It was found after 10 years, when the mean height of thrifty trees (44% of the original planting) was 15·3 ft., that site treatment had not significantly affected survival or height growth. However, trees planted by (*c*) were 0·5–1·0 ft. taller than by (*a*) and (*b*) on 80% of plots. Thus the cheapest combination, viz. (*c*) planting in untreated plots, was at least as successful as any of the others tried. [Cf. *F.A.* 17 No. 2747.]

3085. GRUSCHOW, G. F. **Observations on root systems of planted Loblolly Pine.** *J. For.* 57 (12), 1959 (894–6). 4 refs.

Examination of 2005 bar-planted 3-year-old *Pinus taeda* showed that 67% had malformed root systems caused by poor planting, though this was not apparent from development above ground. In all cases bar-planting had caused flattening of the roots into a vertical plane, and decayed roots were noted on several of the deformed seedlings.

3086. MESNIL, H. Plantation de peupliers à grande profondeur dans les dunes du delta du Po. **[Deep planting of Poplars in the dunes of the Po delta.]** *Rev. for. franç.* 12 (3), 1960 (166–76). 5 refs. [F.]

Mainly a review of Italian reports [cf. *F.A.* 21 No. 1761] on the plantations of the Nobili-Nichetti estate, using rooted cuttings and planting holes ca. 4 m. deep. Photographs of excavated root systems are included. [Cf. also *F.A.* 21 No. 455.]

3087. WRIGHT, T. W. **Use of fertilizers in the afforestation of deep peat.** *J. Sci. Food Agric.* 10 (12), 1959 (645–50). 5 refs. P.O.

P deficiency is frequently the primary factor limiting tree growth on deep peat, but phosphate manuring, combined with deep ploughing, results in successful establishment on all but the worst sites. Foliage analysis has recently proved successful in diagnosing P deficiency. Recent studies have shown that, as the trees mature, natural supplies of other nutrients, particularly K, may become exhausted. Tabulated results are given for Sitka Spruce.

3088. **Tree growth on deep peat.** *Extr.* from *Rep. Macaulay Inst. Soil Res. 1958/59*, [1960] (15–6).

[Cf. *F.A.* 20 No. 4520.] The intensive study of the effects of Lodgepole and Scots Pine on peat at the Lon Mor has been completed, and the results may be summarized as follows. Tree growth has greatly dried out the peat, the extent depending on the depth of the peat and the vigour of the trees, and there has been considerable shrinkage which has resulted in the formation of underground cavities rather than a general settling of the surface. Vigorous trees may suffer from seasonal moisture shortage later in the rotation. Lodgepole Pine on the P-fertilized plot has removed significant amounts of K and inorganic P from the upper layers of the peat. No such effect was detected under the less vigorous Scots Pine. Diameter growth in the fertilized plots has fallen off since 1950 in the Scots Pine, and since 1955 in the Lodgepole Pine. Foliage analysis suggested that this was due to exhaustion of the applied P, or a deficiency of K, or both. A P/K trial was therefore laid down in May 1959, on the Lodgepole Pine experiment, and measurement of diameter growth during 1959 suggests that K is the limiting factor, as has been found with checked Spruce in the same area.

3089. **Forest fertilizer trials.** *Extr.* from *Rep. Macaulay Inst. Soil Res. 1958/59*, [1960] (15).

Determination of height growth and foliage nutrient content of young Corsican Pine growing on sand dunes at Culbin Forest, treated with inorganic fertilizers in 1954 and 1956, has continued [cf. *F.A.* 20 No. 4546]. In the 1956 N/K/Mg experiment, a very significant increase in height growth due to N treatment was observed for the second successive year, and this effect was greater in the presence of Mg. The N treatment increased needle dry weight and also needle P and K, and caused an apparent decrease in needle Ca due to a 'dilution' effect. The K and Mg treatments increased needle K and Mg respectively. Analysis of foliage samples collected at the end of the second growing season from Lodgepole Pine and Sitka Spruce in the N/K/Mg fertilizer trials on deep peat at the Lon Mor showed that the Spruce, which grew well earlier as a result of repeated P dressings, was suffering from acute K deficiency. Needle K content increased in the plots with K, and needle N content was slightly increased by the N treatment. Diameter growth during the 3rd growing season showed an increase in the plots with K. In the Lodgepole Pine plots, the N treatment has caused an apparent reduction in needle P, Ca, and Mg, and the K treatment has increased the needle K.

3090. MARION, J. Un exemple de reprise assurée par l'emploi des engrais sur une plantation d'*Eucalyptus*. **[Establishment guaranteed by the use of fertilizers on a *Eucalyptus* plantation.]** *Rev. for. franç.* 12 (1), 1960 (26–34). 3 refs. [F.]

Six treatments ($K_2SO_4$, superphosphate, $(NH_4)_2SO_4$, a mixture of these, interplanting with *Acacia mollissima*, and untreated controls) were applied in 1951–52 to separate test plots covering 18 ha. north of Mamora forest (Morocco), which were planted at 3 × 3 m. spacing with *Eucalyptus gomphocephala*. The fertilizers were ploughed in to a considerable depth. In 1954, no difference was evident between treated and control plots. An analogous experiment in 1952–53, though the fertilizers were applied to the surface soil just before planting, showed superior growth and survival rates on fertilized plots by Nov. 1953, even after an exceptionally dry year. After one growing season fertilizers had cut mortality to 6·3 vs. 18·7% for controls. After 4 growing seasons 42·4% (475 plants/ha.) of the controls were dead or dying vs. 14% (158/ha.) for fertilized plots. Lowest mortality up to 1956 was 7·5% in superphosphate plots. Interplanting with Acacia had no apparent effects but the experiment had probably not lasted long enough for any such effects to show at the time of writing.

3091. JUNACK, H. Die Ballenpflanzung von Nadelhölzern. **[Ball-planting conifers.]** *Forst- u. Holzw.* 15 (4), 1960 (66–71). 1 ref. [G.g.]

A discussion, based on practical experience, of scope, organization, speed of work and costs, with particular attention to the correct choice of means of transport, depending on the distance the balled plants have to be carried. Planting Pine at 10,000 balls/ha. costs DM. 1460–1970/ha.; Spruce, Larch and Douglas Fir at 5000/ha. cost DM. 930–1185/ha.

### 232.43. Spacing and Arrangement in Plantations

See also Nos. 2931, 2984, 3111, 3142–3, 3727.

3092. KOLPIKOVA, N. M. Vlijanie napravlenija rjadkov posadki na rost sosnovyh kul'tur. **[Influence of orientation of the rows on the growth of Scots Pine plantations.]** *Trud. Inst. Les.* No. 34, 1958 (133–45). 12 refs. [Russ.]

Investigations were made in 12- and 13-year-old Pine plantations to see whether orientation (rows running N.-S. or E.-W.) had any influence on performance. Tree height and diameter, clear length, live crown, crown projection, needle quantity and quality, and branch length and weight were taken into account, and also air temperature and humidity, light, soil temperature and moisture, and wind speeds in the plantations. Results were analysed statistically, and show that, at any rate on the level clay-loam soils of the Moscow region, planting or sowing in N.–S. rows had an advantage, increasing the stem volume of young stands by 15%. The extra growth results from improved microclimatic conditions. It is stressed that these findings should not be applied to other species and sites without preliminary trials.

3093. FREI, S. Erfahrungen bei der Begründung von Nesterkulturen. **[Experiences with the nest method.]** *Arch. Forstw.* 8 (11), 1959 (1017–35). 88 refs. [G.g.russ.e.]

A review of Russian experiences based chiefly on articles appearing in *Lesnoe Hozjajstvo* (1950–58) and of German trials in the Dresden region based on published and unpublished material. Though some plantations have been successfully established on sandy soil by the method as applied in Germany (cultivating the nest site only, leaving the intervening space without tending or intercropping, and planting 9–16 seedlings per nest) results, in general, were disappointing, particularly on the more difficult sites. Costs for soil preparation, planting and tending also exceeded those for row planting. It held certain advantages, e.g. less deer damage when used to fill gaps in natural regeneration.

3094. OKSBJERG, E. B. Planteringsförbandet för gran på god mark i södra Sverige. **[Spacing of Spruce on good sites in S. Sweden.]** *Svenska Skogsv-Fören. Tidskr.* 58 (2), 1960 (57–68). 6 refs. [Sw.]

A lecture based on data from trial plots and other stands, concluding that wider spacings (say 2·5 × 2·5 m.) are preferable because the greater diameters achieved at a given age more than compensate for loss in stand volume and quality (branchiness, wood density and taper). It is thought that the difference would be greatest at ca. 50 years. [Cf. *F.A.* 21 No. 2882.]

3095. LEMMIEN, W. A., and RUDOLPH, V. J. **Growth and yield of Red Pine in three spacings.** *Quart. Bull. Mich. Agric. Exp. Sta.* 42 (2), 1959 (421–7). 4 refs.

The growth and yield of 25-year Red Pine (*Pinus resinosa*) in stands at (*a*) 6 × 6, (*b*) 8 × 8, and (*c*) 10 × 10 ft. spacings, were studied in plantations established in 1932 on abandoned fields in the Kellogg Forest in southern Michigan. Portions of the stand were thinned in 1947 and again in 1954. After 25 years and 2 thinnings, 18% of stems in stand (*a*), 5% in (*b*), and 1% in (*c*) were still unmerchantable. In 9 years all (*a*) and (*b*) and unthinned (*c*) increased 1·8 in. in d.b.h., while thinned (*c*) increased 2·5 in. Height growth of all stands was similar. Stand (*c*) thinned has much larger crop trees, with 98 trees in the 9- and 10-in. classes; (*b*) has 66, unthinned (*c*) has 38, and (*a*) has 18. After 25 years of growth, spacing (*c*) appears superior to (*a*) and (*b*) because it has produced larger crop trees and almost as much merchantable volume per acre. Thinnings in the wider spacings are more easily applied, since there are fewer unmerchantable trees in the stand. Planting costs are lower, and access is easy. [Cf. *F.A.* 20 No. 4517.]

3096. FILHO, O. A. GURGEL. Sôbre o crescimento do pinheiro brasileiro (nota prévia). **[Increment of *Araucaria angustifolia* (preliminary note).]** *Rev. Agric., Piracicaba* 32 (2), 1957 (79–82). 3 refs. [Port.] A.P.B.

Plots were established at the Hôrto Experimental de Santa Rita do Passa Quatro in 1952 at spacings of (1) 1 × 1 m., (2) 1·5 × 1·5 m., and (3) 2 × 2 m. Measurements made in 1956 showed the following mean diam. increments over 4 years: (1) 31 mm., (2) 35 mm., and (3) 42 mm.

3097. VEIGA, A. DE ARRUDA. Área basal do 'pinheiro brasileiro'. **[Basal area of *Araucaria angustifolia*.]** *Rev. Agric., Piracicaba* 32 (4), 1957 (227–32). 4 refs. [Port.port.] A.P.B.

Reports measurements made on plots of *A. angustifolia* after 5 years' growth, given initial spacings ranging from 1 × 1 m. to 3 × 3 m. It is concluded that the ideal b.a. at 5 years old is 16–17 sq. m./ha., and thinnings should be carried out on this basis.

3098. VEIGA, A. DE ARRUDA. Dados preliminares sôbre áreas basais. **[Preliminary data on basal areas.]** *Rev. Agric., Piracicaba* 33 (3), 1958 (133–8). 2 refs. [Port.port.e.] A.P.B.

Presents the results of experiments at the Horto Florestal de Batatais in determining basal areas to be maintained throughout the life of the stand. The following initial spacings in metres and b.a./ha. in sq. m., to be achieved before the first pruning and maintained throughout the life of the stand, are found suitable at the Batatais Horto Florestal: *Araucaria angustifolia* 2 × 2, 23·76–28·53; *A. angustifolia* 1 × 1, 36·73; *Casuarina stricta* 2 × 2, 36·5; *Eucalyptus citriodora* 2 × 2, 56·75–83; *Eucalyptus* sp. 2 × 2, 85–95; *Grevillea robusta* 2 × 2, 49·16–60·825; *Melia azedarach* 2 × 2, 86·5; *Piptadenia communis* 2 × 2, 23·275. Thinnings should usually begin between the ages of 10 and 20 years. These data are preliminary to further experiments.

3099. VEIGA, A. DE ARRUDA. Dados preliminares da área basal do *Cupressus lusitanica*, Mill. **[Preliminary data on basal area of *C. lusitanica*.]** *Rev. Agric., Piracicaba* 34 (3), 1959 (163–8). 3 refs. [Port.port.] A.P.B.

Measurements were made in 1958 on sample plots established in 1952 at spacings of (1) 1 × 1 m., (2) 1·5 × 1·5 m. and (3) 2 × 2 m. Results from (1) and (2) fluctuated *inter se*, and no final conclusions can yet be drawn from these sample plots [cf. *F.A.* 18 No. 387].

3100. VEIGA, A. DE ARRUDA. Área basal da *Acacia mollissima*, Willd. **[Basal area of *A. decurrens* var. *mollissima*.]** *Rev. Agric., Piracicaba* 33 (1), 1958 (21–5). 2 refs. [Port.port.e.] A.P.B.

Presents the results of an analysis of diam. measurements made in 1955 on plots established in 1951 at spacings ranging from 1 × 1 to 3 × 3 m. It is concluded that 2 × 2 m. is the most suitable initial spacing.

3101. FILHO, O. A. GURGEL. Sôbre o crescimento do pau pereira (nota prévia). **[Increment of *Platycyamus regnellii* (preliminary note).]** *Rev. Agric., Piracicaba* 33 (2), 1958 (75–8). 2 refs. [Port.] A.P.B.

Plots were established in 1952 at spacings of (1) 1 × 1, (2) 2 × 1, and (3) 2 × 2 m., and height and diam. measurements were made in 1957. Preliminary results indicate that (1) is unsuitable as an initial spacing.

3102. MELLO, H. DO AMARAL. Ensaio de espaçamento com *Grevillea robusta* Cunn. **[Spacing experiments with *G. robusta*.]** *Rev. Agric., Piracicaba* 34 (4), 1959 (267–72). 6 refs. [Port.port. e.] A.P.B.

Six-month-old seedlings of *G. robusta* were planted at 5 different spacings, i.e. (1) 3 × 1, (2) 3 × 1·5, (3) 3 × 2, (4) 3 × 2·5, and (5) 2 × 2 m., and height measurements made 12 months later. Statistical analyses of the results showed no effects of spacings on development up to this age.

3103. VEIGA, A. DE ARRUDA. Área basal da *Grevillea robusta*, A. Cunn. **[Basal area of *G. robusta*.]** *Rev. Agric., Piracicaba* 32 (1), 1957 (43–7). 3 refs. [Port.] A.P.B.

Measurements of basal area after 5 years' growth of *G. robusta* spaced initially at (1) 2 × 2 m., (2) 1·5 × 1·5 m., and (3) 1 × 1 m. showed a definite superiority for (1).

### 232.44. Season and Time of Planting

See No. 3110.

### 233. Afforestation

See also Nos. 2630, 2683–5, 2915, 3086–90.

3104. MIKOLA, P. Metsänviljelyn mahdollisuuksista pohjoisella metsänrajalla. **[Afforestation**

**trials at the polar timber-line.]** *Metsät. Aikak.* 1958 (11), (374 . . . 379, 389). [Fi.e.]

Describes three areas in N. Finland, growing Scots Pine since 1911–24. Survival has been good, the few losses being attributed to frost damage and use of a provenance from too far south, but growth is slow, dominant heights of 4–5 m. having been reached in 40 years. The period 1920–40 was unusually warm and even natural regeneration was good, but conditions may be less good in future. The establishment of seed orchards of the most northerly strains of Pine in localities further south is recommended to ensure an adequate supply of suitable seed. *From author's summary.*

3105. GOODLAND, N. L. **Reclaiming gravel lands.** *World Crops* 11 (12), 1959 (431–3). O.R.E.

A general account of the reclamation of abandoned gravel beds in England by afforestation with Scots and Corsican Pine and Larch.

3106. KNICKMANN, E. Zur Nutzung unfruchtbarer Böden mit hohem Gehalt an Blei und Zink. **[The use of infertile soils with high Pb and Zn contents.]** *Z. PflErnähr. Düng.* 84 (1/3), 1959 (255–8). [G.g.e.f.] O.R.S.

The plains N. of the Harz Mts. have high contents of Pb and Zn washed down by the rivers. Soils having also a high clay and humus content are suitable for intensive agricultural cropping, but not sandy and gravelly soils. However, experimental plantations of hybrid Black Poplars established on the latter in 1944 have proved successful.

3107. WESTRA, J. J. Een oriënterend onderzoek naar de oorzaken van groeistoornissen in de bosbeplantingen in de Noordoostpolder. **[A preliminary study on the causes of growth disturbances in plantations on the N.E. polder.]** *Uitvoer. Versl. Bosbouwproefsta., Wageningen* 4 (2), 1959. pp. 26. 21 refs. [Du.e.]

[Cf. *F.A.* 18 No. 2816.] Chemical and physical properties of the soils and the growth of tree species (Oak, Ash, Sitka Spruce, Japanese Larch and Alder) were studied. The soils were very varied (different types of sand, boulder clay, peat, etc.) but were all unsuitable for agriculture. Their physical properties, especially structure and water economy, appeared to have more effect on plant growth than their chemical ones, and were strongly influenced by the degree of ripening (the stage in the process by which the sea bottom becomes an aerated soil capable of supporting growth of land plants). The root development of four species was studied; Ash appeared to be most affected by unfavourable root environment, Oak and Sitka Spruce to be moderately tolerant,and Alder very tolerant. Poor aeration was usually the limiting factor, but sometimes, as with boulder clay, there was a mechanical impediment to root development, and some sand layers appeared to hinder root growth for reasons not yet understood. On some sites Oak showed excessive production of Lammas shoots and Larch a tendency to stem curvature, both of which are attributed to excessive N in the soil. Other nutrients present appeared to have little effect.

3108. JONCKHEERE, J. Note sur le boisement des dunes littorales. **[A note on the afforestation of littoral dunes.]** *Bull. Soc. For. Belg.* 67 (2), 1960 (89–95 + 1 photo). [F.]

An account of plantations on the dunes between Ostend and Wenduine, mainly *Pinus nigra* var. *austriaca* and *P. nigra* var. *calabrica*. *P. pinaster* has been tried, but is unsuited to the climate and susceptible to attack by *Fomes annosus* and *Pissodes notatus*. Experiments have also been made with *P. mugo* var. *uncinata*, *P. contorta*, *P. ponderosa*, *P. banksiana* and *P. thunbergii*, all of which were failures.

3109. NEUWINGER, I., and CZELL, A. Standortsuntersuchungen in subalpinen Aufforstungsgebieten. I. Teil: Böden in den Tiroler Zentralalpen. **[Site investigations in subalpine afforestation areas. I: Soils in the Central Alps of the Tirol.]** *Forstwiss. Cbl.* 78 (11/12), 1959 (327–72). 70 refs. [G.g.]

The soils (all podzols) were studied in order to determine the best techniques for preventing avalanche formation and to avoid avalanche damage in this zone. The systematy of the soils, their chemical and physical characteristics, and their relationship to the plant cover were determined. Some practical findings that emerged were: on (*a*) mineral soils, pure Larch should be planted, with mixed Willows/*Alnus viridis* where erosion is a danger; on (*b*) raw-humus soils, *Pinus cembra*/Larch; on (*c*) moder soils, Spruce/Larch. On (*b*) and (*c*), the % of Larch can be reduced, the deeper the A horizon. Pure *Pinus cembra* or Spruce should be avoided. Where damage from erosion, wind, and snow pressure is likely the plant spacing should be reduced, and where there is danger of drought and over-heating the planting area should be kept small. Only soils low in or devoid of humus should be artificially fertilized. Plants should be grown in nurseries under conditions as close as possible to those awaiting them outside.

3110. TRIANTAPHYLLIDIS, G. Anadasōseis diamaurēs peukēs eis tēn Peloponnēson. **[Reforestation with *Pinus nigra* in Peloponnesus.]** *Das. Chron.* 1 (13/14), 1959 (593–8). [Gk.]

Reports renewed activity in afforestation, especially since 1950, with *Pinus nigra* var. *caramanica*, criticizes certain aspects of the sowing and planting done to date, and makes specific recommendations for soil preparation and autumn sowing (September) and planting (15 Oct.–30 Nov.).

3111. KNJAZEV, L. A. O nekotoryh spornyh voprosah lesorazvedenija v zasušlivyh uslovijah zony kaštanovyh počv. **[Some moot points on forestry in the droughty conditions of the chestnut-soils zone.]** *Soobšč. Inst. Les.* No. 12, 1959 (50–61). 14 refs. [Russ.]

Discusses various stand lay-outs and soil cultivation measures, and presents a plan for an experimental plantation, comparing 3 different lay-outs, 4 cultivation treatments, and 3 ratios of shrubs to trees in the stand, which should provide answers to the problems of forest establishment in the zone.

3112. LIMSTROM, G. A. **Forestation of strip-mined land in the Central States.** *Agric. Handb.*

*U.S. Dep. Agric.* No. 166, 1960. pp. v + 74. 58 refs.

Discusses [mainly] the site conditions affecting afforestation of strip-mined land, emphasizing the need for careful site evaluation (i.e. such factors as the physical characteristics of soils, chemical reaction, and topography), and species selection. Special recommendations for planting 23 species are listed, and indications for growth and yield are that trees thus planted will produce saleable crops in as short a time as those on old-field plantations.

3113. Boyce, S. G., and Neebe, D. J. **Trees for planting on strip-mined land in Illinois.** *Tech. Pap. Cent. St. For. Exp. Sta.* No. 164, 1959. pp. 27 + 6 pp. of tbls. 12 refs.

Following trials started in 1947, 17 species were found suitable for planting; 10 of these in all parts of Illinois, and 7 in the southern counties. White Pine and Pitch Pine did poorly. Performance of each species is detailed. [Cf. *F.A.* 13 No. 2969.]

3114. Rahman, R. **Establishment and management of trees and grasses in arid zones of Pakistan. Parts I and II.** *Pakistan J. For.* 9 (3; 4), 1959 (166–87; 273–80).

Part I discusses the needs of W. Pakistan; Part II describes methods of afforestation observed in the arid zone of Morocco, particularly the planting of Eucalypts, and suggests work on the same lines in Pakistan.

3115. Hugon, P. Considérations générales sur les principales activités dans un chantier de reboisement au Kasai. **[The principal activities at an afforestation centre in the province of Kasai.]** *Bull. agric. Congo Belge* 51 (1), 1960 (75–100). 6 refs. [F.f.du.]

Describes the preliminary survey work (including aerial photography), the staff, principal species used, nursery and plantation techniques, and preliminary data on success and failure.

### 235. Underplanting, Advance Planting etc. Nurses and Formation of Mixtures. Interplanting of Inferior Growth

See also Nos. 2850, 3118, 3161.

3116. **Enrichment planting.** *Extr.* from *Rep. For. Dep. W. Aust. 1958/59*, 1959 (27–8).

Direct spot sowings of *Acacia melanoxylon* made in 1928 under open virgin Karri forest produced a number of trees of indifferent form which now measure up to 60 in. in. g.b.h. and 70 ft. high. At ca. 10 years old these original trees began to regenerate by both seed and root suckers, and today each tree has colonized an area up to ½ acre in extent. The progeny are of good form, and straight boles up to 40 ft. are not uncommon.

### 236. Care of Regeneration or Plantations in the Initial Stages of Establishment

See also Nos. 3160, 3291 *et seq.*, 3519.

3117. Treloar, G. K. **Experimental reclamation plantings at Ouyen.** *For. tech. Pap. For. Comm. Vict.* No. 2, 1959 (1–3).

Reviews the condition in 1959 of a plantation in N.W. Victoria, rehabilitated by planting up (1948–56) with 38 *Eucalyptus* spp. and other dry-climate vegetation (*Atriplex nummularium*, *Myoporum platycarpum*, etc.). Sample growth rates indicate very good recovery of a plantation that had been badly hit by drought (1943–45) and other causes, and the importance in this respect of wire-net fencing for excluding rabbits and grazing animals, and of contour ploughing, is emphasized.

### 237. Amelioration of Forest Sites

See also Nos. 2663, 2730–1, 2848, 2850, 2975, 3006, 3034, 3087–91, 3144, 3252–3, 3266, 3312, 3553.

3118. Jentsch, J. Gedanken zur Waldboden-Melioration an Hand des ‘Adorfer Verfahrens’ im obervogtländischen Schiefergebeit. **[Observations on forest soil amelioration on the basis of the ‘Adorf method’ in the Obervogtland phyllite soils region.]** *Arch. Forstw.* 8 (3), 1959 (217–69). 105 refs. [G.g.russ.e.]

[Cf. *F.A.* 17 No. 2776.] A detailed account of the method (fertilizing, cultivation, planting of mixtures and lupins, etc) as practised by the author in the region since 1920, together with appraisals of the method by various authors. The question of the permanence of the achievements of the first 3 decades is discussed, and future prophylactic measures outlined.

3119. Pjavtšenko [P′javčenko], N. I. Soometsade tüübid ja nende kuivendamise loodetav efektiivsus. **[Bog forest types and expected effectiveness of draining them.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 95–100 + 1 tbl. 4 refs. [Est.russ.g.]

Distinguishes eutrophic, mesotrophic and oligotrophic types, gives data on their soil and vegetation characteristics,and discusses the probable effectiveness of draining them. [Cf. *F.A.* 21 No. 465.]

3120. Sarma, P. Rabade kuivendamise metsanduslik efektiivsus. **[The effectiveness of draining raised bogs for forestry.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 120–5. 2 refs. [Est.russ.g.]

Discusses data showing that forest establishment is possible on raised bogs after intensive drainage, and argues that the time is now ripe for trials in the Baltic Republics.

3121. Voolin, J. Metsakuivendus Eesti NSV-s. **[Forest drainage in Estonia.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 10–22. [Est.russ.g.]

An account of achievements in the last 100 years, especially since 1918. An area of > 140,000 ha. is to be drained in 1959–65.

3122. Kollist, P. Eesti NSV Teaduste Akademia Zoologia ja Botaanika Instituudi metsasektori teaduslikust uurimistööst soometsade alal. **[Investigations on boggy forests by the Forestry Department of the Zoological and Botanical Institute of the Estonian Academy of Sciences.]** In *Metsakuivenduse Küsimusi.*

Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 43–54. 12 refs. [Est.russ.g.]

Discusses the effect of drainage on the yield of stands on transitional forest bogs. The yield of *Betula pubescens* is not sufficient to justify drainage for it, whereas drainage pays with Pine and Spruce. Since, on drained, clear-felled areas, Birch replaces Pine and Spruce, methods of artificial regeneration of the latter have been worked out. Trials are also in progress to determine the feasibility of using raised bogs for forestry.

3123. Kronit, J. Metsakuivendus Läti NSV-s. **[Forest drainage in Latvia.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 23–8. [Est.russ.g.]

An account of achievements since ca. 1830, and especially since the Second World War. An area of 210,000 ha. is to be drained in 1959–65.

3124. Bušs, K., and Sábo, E. D. Mõnede Läti NSV metsatüüpide kuivendamise intensiivsusest ja ökonoomilisest efektiivsusest. **[The intensity and economic effectiveness of drainage in some forest types of Latvia.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 55–68. 3 refs. [Est.russ.g.]

Investigations in various types of Pine forest showed that the optimum ditch spacings and depths were: 100–140 m. and 70 cm. in *Sphagnum* types (with a thin peat layer); 160–200 m. and 100 cm. in *Carex/Phragmites* types; and 90 m. and 60 cm. in *Molinia/Vaccinium* types.

3125. Sarma, P. Ė. Vlijanie osušitel′noj melioracii na povyšenie produktivnosti lesa v uslovijah Latvijskoj SSR. **[The influence of drainage on improving forest site quality in Latvia.]** *In* 'Sbornik Statej po Rezul′t. Issled. v Oblasti Lesn. Hoz. i Lesn. Prom. v Taežnoj Zone SSSR'. Moscow. 1957. pp. 158–70. 18 refs. [Russ.]

Presents graphs showing the influence of drainage on the site quality of: (1) peat soils, as related to (*a*) amount of sphagnum in the peat, and (*b*) thickness of the peat layer; (2) of Pine and Spruce, as related to (*c*) stand age and botanical composition of peat, and (*d*) distance from drain and botanical composition of peat.

3126. Rasimavičius, B. Metsakuivendustööd Leedu NSV-s. **[Forest drainage works in Lithuania.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 29–37. [Est.russ.g.]

An account of work since 1855, and especially since 1946. An area of 75,000 ha. is to be drained in 1959–65, and special attention paid to forest road-building.

3127. Kapustinskaite, T. Kuivendamise mõju mustlepikute kasvule ja uuendamisele Leedu NSV-s. **[The influence of drainage on the growth and regeneration of Lithuanian *Alnus glutinosa* forests.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 69–79. [Est.russ.g.]

[Cf. *F.A.* 21 No. 1741.] Drainage impairs the growth of Alder stands of the *Urtica* type, but in the *Carex* type drainage before felling improves regeneration, and stands on drained ground give greater yields.

3128. Pronko, V. Hüdromelioratsioonitööd Valgevene NSV riikliku metsafondi maadel. **[Drainage works in Belorussia.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 38–42. [Est.russ.g.]

An account of forest drainage since 1873. In 1951–57, some 24,667 ha. were drained; in 1959–65, drainage is to be done on 140,000 ha.

3129. Walker, L. C., and Tisdale, S. L. **Forest fertilization research in the South.** National Plant Food Institute, Washington, D.C. 1959. pp. iii + 50. 71 refs.

A report by the Institute's Southern Forest Fertilization Task Force, including a review of literature (mainly American), chiefly on growth and flowering responses of Southern Pines; a list of current research projects classified by main object, species, location, and sponsoring body; suggestions for further research and the conduct of experiments; notes on grants-in-aid made by the Institute, exchange of information organized by it, etc.

3130. **Forest fertilization information clearing house program.** National Plant Food Institute, Washington D.C. 1960. pp. 51.

A first circular letter to participants in the clearing scheme, listing 101 research projects on fertilization of forest trees, with preliminary results if any, in the S. and S.E. of the U.S.A. by 36 bodies, federal, state, and private.

3131. Hartmann, F. Vorläufige Ergebnisse einiger Waldkalkungsversuche in Österreich. **[Preliminary results of some Austrian liming trials.]** *Allg. Forstztg.* 71 (3/4), 1960 (27–31). 10 refs. [G.g.]

An evaluation of 13 field trials established 7 or 8 years earlier, mostly by superficial application of $CaCO_3$ in varying dosages in conifer stands (largely Spruce). Results differed considerably with the (generic) kind of humus present [cf. *F.A.* 14 No. 1867; 18 No. 27]. Frequently, however, the effect, in terms of improved biological activity, pH, and N relations, was negligible, or at any rate neither penetrating in depth nor lasting, unless a ground vegetation—originally present or adventitious—of grasses, herbs, or shrubs introduced the lime into the nutrient cycle [cf. *F.A.* 19 No. 3755]. Neither mosses nor the trees themselves could do this, but *Vaccinium myrtillus* was very successful, preventing the reformation of an acid top layer. The need for careful site investigations is stressed. In most cases the lime would need to be worked into the mineral soil, and with many unfavourable (eumycete or anaerobic) humus types, additional measures, particularly planting of lupins or woody soil-improvers would be required.

3132. Franz, H., and Loub, W. Bodenbiologische Untersuchungen an Walddüngungsversuchen. **[Soil biology investigations in connexion**

**with forest fertilizer trials.]** *Cbl. ges. Forstw.* 76 (3), 1959 (129–62). 21 refs. [G.]

A detailed analysis of the bacterial and fungal soil flora, and of the soil fauna, by quantity, composition and chief function (nitrification and denitrification), cellulose composition, secretion of acids or inhibitory substances, etc., and of changes in total N, C/N ratio etc. in the humus types in Spruce stands subjected to various fertilizer treatments. This is based partly on research already summarized [see *F.A.* 18 No. 1592; 20 No. 4544; 21 No. 474] and partly on additional investigations, including older trials in Württemberg [cf. *F.A.* 17 No. 1560] and Austria. On plots first treated in 1950 or 1952, the changes in ground flora were largely completed, but the chemical and biological changes were still developing. Six years after treatment, plots that had received the largest doses of $NH_4NO_3 \cdot CaCO_3$ still had the greatest number of bacteria and generally also the most favourable soil fauna (lumbricids). The good effect on quantity and composition of the soil flora was still quite marked in plots treated 15 and even 50 years earlier with $CaCO_3$, with or without basic slag. Results so far point to the importance, from the soil-biological point of view, of using N on acid forest soils in combination with Ca and, in all probability, P. N alone, in the form of $(NH_4)_2SO_4$, and very large doses of fertilizers (though the raw humus layers on the plots investigated had somewhat buffered the effect) are considered unfavourable for the biocoenosis of the soil.

3133. OLDIGES, H. Der Einfluss von Waldbodendüngung auf das Auftreten von Schadinsekten. **[The effect of fertilizing in the forest on injurious insects.]** *Z. angew. Ent.* 45 (1), 1959 (49–59). 48 refs. [G.g.e.] O.H.

Describes field and laboratory experiments in 1957 and 1958 on fertilizer trial plots (*A*) at Schwabach [cf. *F.A.* 21 No. 475] and (*B*) at Bodenwöhr, Upper Palatinate, (*a*) in 70-year-old stands treated in 1951 with 2500 kg. $CaCO_3$/ha. and interplanted with lupins, and (*b*) in a plantation treated on planting in 1934 with 2500 kg. $CaCO_3$/ha. and interplanted with *Alnus incana*. Tests with *Lymantria monacha* and *Bupalus piniarius* are described in greater detail than in the earlier paper. Young larvae of both, when offered food branches from different plots, clearly preferred those from controls. *Dendrolimus pini* and *Panolis flammea* larvae also showed higher mortality on food from N plots in the early stages. For *P. flammea* the effect was largely mechanical, i.e. coarser bud scales and greater resin flow hindered their entering the buds. The N plots also had a higher population of *Cinara pini* than controls. In (*B*, *a*), treated plots had fewer pupae of *B. piniarius* and, presumably because of the richer ground flora, more parasitization of larvae, but not higher larval mortalities. In (*B*, *b*), larval mortality was higher on the treated plots.

3134. ZÖTTL, H. Voraussetzungen für eine wirkungsvolle Verbesserung der Stickstoffversorgung von Nadelholzbeständen. **[Conditions for an effective improvement of N supplies to conifer stands.]** *Z. PflErnähr. Düng.* 84 (1/3), 1959 (116–22). 29 refs. [G.e.f.] O.R.S.

Reviews literature, mainly European, with particular reference to the poor growth of Pine and Spruce in Bavaria. Subjects discussed are: fixation of atmospheric N by legumes, mineralization of fixed N in raw humus and the use of commercial fertilizers (quantities, season of application, etc.).

3135. JOHANSSON, B., and ÅHGREN, A. Gödsling av skogsmark. **[Fertilizing forest soils.]** *Norrlands SkogsvFörb. Tidskr.* 1959 (4), (381–424). 19 refs. [Sw.]

Describes visits to Norway (Sokna) and Germany (Harsefeldt, Boitzenhagen and Hann. Münden) in 1956 and 1958 respectively, and discusses the results obtained there from applying fertilizer to drained peatland, regeneration areas, or *Calluna* heath. Discusses also the lay-out, rates and methods of application, and costs of fertilizer experiments begun in 1957–59 by the SCA [Svenska Cellulosa Aktiebolaget?] in its central and southern forest lands. Preliminary examinations showed increased vigour among plants, especially Pine, on treated peatland, and considerably increased needle length among those on treated heath. Costs of applying fertilizer from the air are estimated at Kr. 250/ha., for a rate of 500 kg. NPK/ha., on drained peat, and at Kr. 300/ha. for 150 kg. N/ha. on an established Spruce stand.

3136. OLSEN, H. C., RAFN, J., and SCHEURER, E. Revision af et gødningsforsøg i en stagnerende rødgrankultur i Fængselvæsenets plantage ved Sdr. Omme. **[Inspection of a fertilizer experiment in a stagnating Norway Spruce stand in the Fængselvæsen's plantations near S. Omme [central Jutland].]** *Forstl. Forsøgsv. Danm.* 26 (2), 1960 (325–8). [Dan. e.*e.*]

The experiment was laid out in 1954 in a stand, 16 years old from seed, on *Calluna* heath. Height c.a.i. for 1953–58 is shown in a graph and tables, and statistical analysis gave the following preliminary results: (1) N and $H_3PO_4$, separately and combined, increased height increment in the years 1955–58, and all fertilizers (i.e. N + $H_3PO_4$ + metals + B) in the years 1954–58; (2) the quantity of water supplied had no effect on height increment; and (3) the effect of metals + B was doubtful and further replications are needed.

3137. GILMORE, A. R., and BOGGESS, W. R. **Second-year growth response of Shortleaf Pine [*Pinus echinata*] in Southern Illinois to fertilization.** *For. Note Ill. Agric. Exp. Sta.* No. 88, 1960. pp. 2. 1 ref.

The effect of treatments (*a*), (*b*), (*c*) given in March, 1958 [see *F.A.* 20 No. 4545] during the second year after application (1959) was examined. Mean diam. increment for (*b*) was significantly greater (1% level) than that for (*c*), an expected response for soils low in available $P_2O_5$, though its delayed nature cannot be explained from the information gained in this experiment. The 2-year diam. increment for (*a*) and (*b*) was almost the same, the means being 4·4 and 4·6% respectively, vs.

3·5% for (*c*). Although these increases are relatively small, the fact that they were obtained by treating a stand of such high b.a. (ca. 180 sq. ft./acre) emphasizes the importance of nutrient elements in tree growth.

3138. Brüning, D. Forstdüngung. Ergebnisse älterer und jüngerer Versuche. [**Forest fertilizing. Results of older and more recent trials.**] Neumann Verlag, Radebeul. 1959. pp. 210 + 1 tbl. 138 refs. [G.g.russ.e.] Price *DM*.25.

Describes experiments on degraded sandy soils in N.E. Germany, mainly on the effect of K + Mg. Scots Pines 20–25 years old, fertilized with K + Mg at planting or 1 year after sowing (when they showed deficiency symptoms) and again after 5 years, had had fewer early losses and showed greater heights and diameters, though the difference in growth rate had disappeared at 10–12 years. In a trial with various combinations of P, K, Ca and Mg, established in 1950, with (*a*) *Robinia pseudoacacia*, (*b*) *Quercus borealis* and (*c*) Pine seedlings, (*a*) responded to K + Mg by fewer losses, better height and root growth, increase in root nodulation, flowering, frost resistance and resistance to *Eulecanium corni*, with only 20–134 adult ♀s per three 10-cm. lengths of shoot against 2782 on fertilized but K-less plots and 9128 on untreated controls; (*b*) showed increased height growth on the K and Mg plots, though this was masked by preferential browsing by hares and rabbits. No clear response was observed in (*c*). Other tests on 3-year-old Pine seedlings indicated that K stimulated growth more than Mg. *From author's summary.*

3139. Brüning, D. Ergebnisse der Aufnahme 1957/58 von Robinien und Roteichen auf dem Düngungsversuch Scheeren (St FB 'Colbitzer Heide'). [**Evaluation in 1957–58 of *Robinia pseudoacacia* and *Quercus borealis* in the Scheeren trial (Colbitzer Heide state forest).**] *Arch. Forstw.* 9 (1), 1960 (68–83). 8 refs. [G.g.russ.e.]

The evaluation confirmed earlier results. [Cf. preceding abstract.] All K plots were superior to K-less plots, and those that, in addition to K, had received most Mg were best. Those that had received less Mg had overtaken the K-only plots. *From author's summary.*

3140. **N–P balance.** *Extr.* from *Rep. Dep. For. Qd. 1958/59*, 1959 (19–20).

A pot experiment was made to test the effect of N, P, S and Mg on the growth of *Pinus taeda* in a lateritic podzolic soil. A factorial combination of treatments at 3–4 different rates was used. The experiment was sown in July 1957 and harvested in May 1959. The containers were undrained, 7-in.-diam. polythene canisters, 12 plants being grown in each. N and P increased the yield in terms of dry matter produced (shoots + roots). S reduced the yield and Mg increased it, both effects being significant at the 5% level (these results are not discussed further). There was a highly significant N/P interaction. Although P increased the yield at all levels of N, best yields were obtained in the presence of 6 cwt. $NaNO_3$/acre. No significant increase in yield, however, was obtained by increasing the level of P beyond 1·72 cwt. $NaH_2PO_4$/acre (equivalent in P content to 4 cwt. superphosphate/acre). There was no response to N at the lowest levels of P, but when P was present in adequate amount the yield increased as the level of N increased. Experimental data are given in tables. This demonstration of a pronounced N/P interaction explains many puzzling results obtained in earlier pot trials. If the effect is shown to exist in the field also, it may help to explain why Pines sometimes fail to respond to P fertilizers on sites that are deficient in P.

## 238. Timber Plantation Crops requiring Special Treatment

See also Nos. 2933–4.

3141. Piccarolo, G. Pioppicoltura e coltura accelerata delle piante da legno a rapido incremento in Italia. [**Poplar-growing and silviculture of other fast-growing woody species in Italy.**] [Ente Nazionale per la Cellulosa e per la Carta, Rome.] 1959. pp. 58. [It.]

A paper presented at a meeting of the Italian section of TAPPI (Bari, Sept. 1959), dealing with breeding and trials of Poplars, Eucalypts and fast-growing exotic conifers.

3142. Pavša, J. Rezultati plantažnog uzgoja topola u šumariji Varaždin 1956–1959 g. [**Results of growing Poplars in plantations in the Varaždin forest district, 1956–59.**] *Topola, Beograd* 3 (10), 1959 (811–21). [Serb.f.]

In experiments begun in 1956, rows of *Populus* × *canadensis* (spacing 7 × 7 m.), were interplanted with basket Willows or agricultural crops (potatoes the first, maize the second and third and an oats/clover mixture the fourth year). Details of costs and yields show that potatoes were not profitable but that the other crops ensured a profit over the period. The Willows gave greater financial yields when planted with Poplar but increment of the Poplars was poorer than with the agricultural crops. In 1958, Poplar cuttings were planted at 7 × 0·50 m. and the rows interplanted with various cereals which all gave good yields; in spring 1959, the Poplars were thinned to 3·5 m. and the plants removed were used as planting stock. Conclusions from the experiments as a whole are that Poplars grown in this way have a higher increment and are freer from diseases and pests than those grown in the forest.

3143. Georgopoulos, A. L'espacement dans la plantation de peupliers et la populiculture intensive. [**Spacing in Poplar plantations and intensive Poplar cultivation.**] [*Docum.*] *10th Sess. Int. Poplar Comm., 1959* No. *FAO/CIP 95E* (*Add.* 2), 1959. pp. 4. [F.]

After 4 years, plots in E. Macedonia spaced 2·5 × 3 m. had nearly twice the b.a. of plots spaced 5 × 6 m., and nearly ½ of the b.a. could be taken in a first thinning (a definite advantage in a country where wood is scarce). Intercropping with maize in some of the widely spaced plots increased b.a. and mean diameter. [Cf. *F.A.* 14 No. 311; 17 No. 1574.]

## 24. Tending of Stands and Trees

See also Nos. 2935, 2946, 3612.

### 242. Thinning

See also Nos. 2882, 2931, 3095, 3097–8, 3152, 3207–8, 3228, 3519, 3557, 3727.

3144. Zviedris, A. Hooldusraiete efektiivsuse arvestamine kuivendatud metsatüüpides. **[Calculating the effectiveness of thinnings in drained forest types.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 145–51. 1 ref. [Est.russ.g.]

Describes the method used. Results to date indicate that the response of Spruce to thinnings is 2–3 times that of Birch and Pine.

3145. Dittmar, O. Zur Frage des 'Wuchsbeschleunigungseffekts' durch starke Durchforstung im jungen Fichtenbestand. **[Growth acceleration through heavy thinnings in young Spruce stands.]** *Arch. Forstw.* 8 (10), 1959 (923–45). 37 refs. [G.g.russ.e.]

An analysis of data from two even-aged sample plots established by Schwappach in 1907 in a plantation on a class-II bunter-sandstone site, covering a period of 36 (ages 21 to 56) years. In the heavily thinned plot (*a*), volume m.a.i. at 40 was 45% greater than on the lightly thinned plot (*b*). Thereafter c.a.i. in (*a*) lagged behind (*b*), though at 56 years its m.a.i. was still 6% greater. This is considered to support the view that on good sites Spruce should be thinned heavily in youth, but not later in life.

3146. Alexander, R. R. **Thinning Lodgepole Pine in the central Rocky Mountains.** *J. For.* 58 (2), 1960 (99–104). 5 refs.

Thinning trials on *Pinus contorta* were begun between 1924 and 1934 in 4 national forests in Colorado and Wyoming. Plots were thinned to different intensities in stagnated and overstocked 35- to 78-year stands, with controls, and remeasured in 1955. All intensities stimulated diameter increment, especially on the most heavily thinned plots. Stand b.a. increment was also stimulated in most treatments, being greatest after heavy thinning in older and larger stands and after light thinning in the younger stands. If there is a market for small material, and only one pre-commercial thinning is possible, thinning to 600, 500 and 400 trees/acre is recommended when initial b.h. diameters are 1–2, 3, and 4 in. respectively. For stands with mean diameters of ⩾ 5 in. a light commercial thinning leaving 300 trees/acre may be possible. If only one pre-commercial thinning is possible, with no market for material below sawlog size, a reserve of 300 trees/acre is recommended for stands with a mean diameter of 1–5 in.

3147. Williams, R. D. **Growth and yield of a thinned Shortleaf Pine plantation.** *Tech. Pap. Cent. St. For. Exp. Sta.* No. 169, 1959. pp. 12. 3 refs.

In 1951 a stocking-density study was established in a 14-year *Pinus echinata* 6 × 6 ft. plantation in S. Indiana. Twelve plots were thinned to 3 different b.a.'s/acre: (*a*) 80, (*b*) 100, and (*c*) 120 sq. ft., and 4 plots (*d*) were left unthinned as controls (124 sq. ft.). In 1958 (*a*)–(*c*) were again thinned to the same b.a. as previously. Diameter growth was greatest on (*a*), but b.a. growth was slightly greater on (*d*); there was, however, little difference in the diam. or b.a. growth of 100 crop trees per acre. No difference in height growth due to thinning intensity was noted. Volume growth increased rapidly on all plots after the 14th year, but was greatest on (*d*), which, in the 7 years 1951–58, produced 5 cords/acre more wood than (*a*) plots. *Fomes annosus* was recorded in (*a*) and (*b*) plots in the sixth growing season after thinning. If it becomes widespread and no control is found, future plantings may be spaced wider to make early thinning unnecessary. Hardwoods were invading all plots, particularly near plantation edges and on the (*a*) plots. Heavy thinning in young stands may introduce severe hardwood competition long before stands are ready for felling. It appears that if *P. echinata* plantations on similar sites are left unthinned until at least 20 years old, more and better products may be expected. Optimum age for the first thinning may be even greater. *From author's summary.*

3148. Teeguarden, D. E., and Gordon, D. T. **A precommercial thinning in Ponderosa and Jeffrey Pine.** *J. For.* 57 (12), 1959 (900–4). 5 refs.

Describes methods used in thinning natural stands of retarded *Pinus ponderosa* and *P. jeffreyi* to a 9-ft. spacing in N.E. California. More than 22,000 trees were released on 44·8 acres within a gross area of 519·4 acres. Mean total cost per tree released was 9–10 cents (2·8 man-minutes); per net acre $48.61 (24·9 man-hours); and per gross acre $4.19 (2 man-hours).

3149. Viney, R., and Pardé, J. Pour le dossier des chênes de qualité. **[The question of high-quality Oak.]** *Rev. for. franç.* 12 (1), 1960 (44–54). 14 refs. [F.]

Discusses Lorne's article [see *F.A.* 21 No. 1791] and suggests that his advocacy of a shorter rotation and heavier thinning after 100 years for *Quercus sessiliflora* (to give annual rings of 2 mm., boles of 80 cm. diameter at 220 years with 60 trees/ha.) is based only on the very fertile conditions of Bon Bercé forest. A maximum annual ring width of 1·5 mm. for high-quality Oak is proposed here to meet German competition in the European Common Market, and slenderer but longer boles are defended.

3150. **Thinning in [Karri] regrowth stands.** *Extr.* from *Rep. For. Dep. W. Aust. 1958/59*, 1959 (27).

Crown thinning in even-aged 25-year regrowth of *Eucalyptus diversicolor* produced marked response within 3 years of thinning. For treatments leaving 20, 40, 60 and 80 crop trees of > 36 in. g.b.h./acre, b.a. increment %s of 1·7, 1·4, 1·1 and 1·0 respectively were obtained. Thinning from below to 60 crop stems produced an increment of 1·1% compared with 0·7 for thinning from above to the same number.

3151. Colclough, D. M. **Thinning to favor selected hardwood species.** *Fox For. Note* No. 74, 1959. pp. 3.

Makes observations on thinning experiments designed to favour the predominant *Acer saccharum*, Basswood (*Tilia* spp.) and Red Oak in mixture with Beech, Birch, White Ash and Red Maple. Tabulated data show volume increases of favoured trees, especially of the faster growing species, on thinned plots, compared with unthinned controls. The volume of all trees on thinned plots also increased relatively more than on controls. Sprout clumps left untouched on the control plots reduced individual tree quality.

## 243. Opening of the Canopy (Increment Fellings, Overhead Release and Improvement Fellings)

See also Nos. 3176, 3200, 3311, 3365, 3484.

3152. Morrow, R. R. **Chemi-thinning hardwoods in the dormant season.** *Proc. 13th Ntheast. Weed Control Conf.* 1959 (356–9). 7 refs. From *abstr.* in *Weed Abstr.* 8 (10), 1959 (4964). O.W.

[Cf. *F.A.* 19 No. 4203.] Dormant-season frill treatments on hardwoods were successful where frill girdling was complete and chemical was added to cause a girdled area of dead wood. The chemical used was of secondary importance, but 2,4,5-T caused quicker top kill (3–6 years) than 2,4,-D in oil or than oil alone. Beech dies more slowly than most hardwoods. Tree vigour, root grafts, or poor growth conditions may greatly affect the results. Dormant-season frilling acted more slowly than summer frilling; spring frilling may give poor results because of excessive sap flow. 2,4,-D (amine) applied in notches in the dormant season caused only 30–40% crown kill for most hardwoods but *Populus tremuloides* and *P. grandidentata* were top-killed within a year. *From author's summary.*

3153. Wiant, H. V., Jr., and Walker, L. C. **Seasonal influences on effectiveness of frill applications of growth regulators in hardwood control.** *Proc. 12th Ann. Sth. Weed Conf.* 1959 (117–22). 5 refs. O.W.

Summer and winter treatments were made on 20 different hardwood species, using 4 commercial arboricides, and the results evaluated 3 years after treatment. Winter treatments gave appreciably better top-kill and less coppicing than summer applications.

3154. Harrington, T. A., and Kring, J. S. **Time for the tree injector.** *Sth. Lumberm.* 200 (2491), 1960 (40, 42).

In E. Tennessee conditions, the man-hours required to inject trees can be estimated by multiplying the sum of the diameters (in inches) to be treated per acre (*S*) by 0·0023 and adding 0·49; and the amount of poison required in gal. per acre by multiplying *S* by 0·0014.

3155. Peevy, F. A. **Effectiveness of aerial applications of herbicides for hardwood control in Louisiana.** *Abstr.* in *Proc. 12th Ann. Sth. Weed Conf.* 1959 (116). O.W.

A test of 7 different herbicides was carried out in May 1957 by aerial spraying at 5 gal./acre. Observations 14 months later indicated that the most effective for hardwood control was the butoxy ethanol ester of 2,4,5-T applied in oil/water emulsion at 2 lb./acre. This gave effective control of Blackjack Oak, Post Oak, Black Oak and Sweetgum, a fair kill of Hickory and White Oak, and poor kill of Red Maple and Water Oak. The propylene glycol butyl ether ester of 2,4,5-TP applied in oil/water emulsion at 2 lb./acre ranked second in effectiveness, but it was less effective than 2,4,5-T on Sweetgum, Black Gum, White Oak and Black Oak. The amine salt formulations of 2,4,5-T, 2,4,5-TP and 2-(2,4-DP) were much less effective than the esters. Damage to Pines was negligible.

3156. Catinot, R., and Leroy-Deval, J. Essais de destruction de la forêt dense, par empoisonnement, au Gabon. **[Tests made in Gaboon on the destruction of '*forêt dense*' by poisoning.]** *Bois For. Trop.* No. 69, 1960 (3–16). 2 refs. [F.e.span.]

Each year 1200 ha. are cleared to allow planting of Okoumé (*Aucoumea klaineana*) in Gabon. It was found that spraying growth regulators (2% concentration in diesel oil) on bark gave an inadequate kill of 60–65%. Spraying after (*a*) blazing, (*b*) girdling, and (*c*) frill girdling was tested. Both (*b*) and (*c*) gave > 80% kill, (*c*) being the easiest and cheapest. No difference in efficacy was noted between 2,4-D and 2,4-D + 2,4,5-T. Recommended treatments (on bark, one girdle, or 2 girdles) for 141 species, arranged in families, are tabulated with test results. Seven species which after 12 months had not succumbed to the most effective treatment are listed, and a brief practical key, based on the similar reactions of related groups of trees, is given for the guidance of clearing gangs. First trials with American 'Little Beavers' for mechanical girdling were satisfactory.

## 245. Tending of Trees, Pruning etc.

3157. Bridge, T. E. C. **Extra-high pruning at Ashley Forest.** *N.Z. J. For.* 8 (1), 1959 (148–51).

Trials to find the best method of extra-high pruning of Radiata Pine are described. The equipment used includes the Swedish sectional tree-climbing ladder, curved pruning saws on 4-ft. adze handles, and safety belts and helmets. A standard practice has been evolved of pruning 50 selected stems/acre in a 19-year stand to a minimum height of 32 ft. (average 36 ft.) at a contract price of 3*s*./tree.

3158. Sluder, E. R. **Growth and the effect of pruning in a stand of Sycamore in the Southern Appalachians.** *Sth. Lumberm.* 199 (2489), 1959 (145–6).

In a pure stand of Sycamore [*Platanus occidentalis*] near Asheville, N.C., some trees were pruned, when 9 years old, to 12 and some to 18, and again to 18 and 26 ft. respectively 3 years later. Evaluation at 20 years showed no effect on growth (mean d.b.h. 13 in., mean height 79 ft.), stem form, or branching in the upper bole, and epicormic branching was negligible. Clear length averaged 20·5 and 26·8 ft. respectively against < 12 ft. for controls. Pruning scars were still visible, but the butt logs are expected to be Grade I at maturity.

### 249. Tending: Miscellaneous

3159. **South-west Queensland.** *Extr.* from *Rep. Dep. For. Qd. 1958/59*, 1959 (25).

An experiment was established in 1957 to determine the influence of a dense undergrowth of *Casuarina luehmanni* on the growth of a fully stocked stand of *Callitris calcarata* ca. 40 ft. high. Treatments applied were (*a*) untreated control, (*b*) all undergrowth cut, (*c*) all undergrowth cut and stumps treated with 1% 2,4,5-T amine in water. C.a.i. in inches (for g.b.h.) for 1957–59 was (*a*) 0·10, (*b*) 0·55, and (*c*) 0·59, and the corresponding value increment (in shillings/acre) was 11·5, 42·5, and 66·2. Crown density and vigour have also improved on treated plots. On (*c*), 90% of stumps were killed; on (*b*) 90% have coppiced and the returning undergrowth will probably again be competing with the *Callitris* in a few years' time.

### 25. Treatment of Defective, Derelict or Very Open Stands

See also No. 3003.

3160. WALTERS, R. S. **Conversion planting on poor hardwood sites shows promise in Ohio.** *Tech. Pap. Cent. St. For. Exp. Sta.* No. 168, 1959. pp. 5.

Stunted and defective hardwoods (*Quercus* and *Carya* spp. were common) were clear-felled late in 1953 on 3 blocks each consisting of two ½-acre plots, on a poor ridge-top site in the Vinton Furnace Experimental Forest, S.E. Ohio. The plots were planted in spring 1954 with a mixture of *Pinus echinata*, *P. rigida*, and *P. strobus*, at 7 × 7 ft. spacing. In summer 1954, and again in summer 1956, half the plots were released by cutting vigorous hardwood regrowth and spraying stumps with 2,4,-D and 2,4,5-T in fuel oil. In 1958, after 5 growing seasons, Pine survival was 80% on (*a*) released plots and 71% on (*b*) unreleased plots; *P. strobus* survived best. Survival was best on the poorest site. On (*b*) in 1958, 43% of *P. strobus* and 71% of *P. rigida* and *P. echinata* were taller than competing regrowth, totalling 357 trees/acre vs. 238 trees/acre in 1956, indicating that the Pines are outgrowing the hardwoods. Mean height on (*a*) was greater than on (*b*), but (*b*) growth should increase as more trees outstrip the hardwood regrowth; sufficient unreleased Pines to form a reasonably well stocked stand have already done so. Thus, on poor sites, early release is probably not justified.

3161. USMAR, R. K. **Management of an exploited Tawa forest.** *N.Z. J. For.* 8 (1), 1959 (109–20). 3 refs.

Some 570,000 acres of mixed forest, now dominated by Tawa (*Beilschmiedia tawa*) after destructive Podocarp logging in the past, present a problem in management. Preliminary trials indicate that selective logging combined with enrichment by group planting of valuable species should prove practicable. The need for much more research on the regeneration of indigenous forests is emphasized.

### 26. Combinations of Forestry with Agriculture and Pastoral Husbandry. Irrigated and Floodland Forests, Shelterbelts etc., and their Treatment

### 261. Alternate Forestry and Agriculture, Periodic or Temporary Agricultural Use of Forest Land

See also Nos. 2946, 3905.

3162. COLE, R. **Temiar Senoi agriculture: a note on aboriginal shifting cultivation in Ulu Kelantan, Malaya. Part II.** *Malay. Forester* 22 (4), 1959 (260–71).

[Cf. *F.A.* 21 No. 495.] Describes the system in use (the *Jerami* system, designed to obtain two crops of rice from the same farm) and variants of it, and makes suggestions for regulating it by strict economy in the use of land and replanting with fast growing species.

3163. GREENLAND, D. J., and NYE, P. H. **Increases in the carbon and nitrogen contents of tropical soils under natural fallows.** *J. Soil Sci.* 10 (2), 1959 (284–99). 39 refs.

The rate of increase of humus C in soils rested under natural fallows in Ghana has been calculated, assuming that its rate of decomposition is proportional to the amount present, and that the rate of addition, by humification of litter and roots, remains constant. The rate of decomposition was derived from knowledge of the maximum humus content that the soil attains under the fallow vegetation, and the rate of addition was estimated from litter-production data. The rate of N increase was also calculated assuming a contant C/N ratio. Under the practice of shifting cultivation in forest, the alternation of cropping and fallowing leads to relatively small fluctuations in soil humus at about 75% of the maximum level. The rates of increase of soil N at this level are 20–50 lb./acre p.a. in forest, and 4–10 lb./acre p.a. in savanna. It is shown that, if vegetation re-establishes itself rapidly, a crop/fallow ratio of about 1/3 should maintain the humus content in forest soils at the 75% of equilibrium level, a result that accords well with experience. *From authors' summary.*

### 262. Fuel and Fodder Forests

3164. DIMITRIJEVIĆ, Ž. Prinosne i zapreminske tablice za hrastove visoke lisničke šume i lisničarena stabla. **[Yield and volume tables for Oak high forest lopped for fodder, and similarly treated coppice forest.]** Poljoprivredna Komora Narodne Republike Srbije, Belgrade. 1958. pp. 80 + 1 tbl. 24 refs. [Serb.e.]

Of the forests producing leaves for cattle fodder in the Grdelička Klisura and Vranjska Kotlina regions, the high-forest type is the more common. The collection and analysis of data and the construction of the local tables are described in detail, and data are also given on the volume of branches and weight of leaves.

3165. SHABNAM, S. R. **Vanamahotsava [Tree festival]: fodder tree species for Himachal Pradesh.** *Indian For.* 85 (12), 1959 (736–9).

Lists species suitable for planting in different climatic zones.

### 266. Shelterbelts, Windbreaks

See also Nos. 2635, 2707, 3387, 3922.

3166. SUN, C.-S., and LIU, C.-H. **[Establishing shelterbelts on canal irrigation systems in the central basin of the Hwang Ho river.]** *For. Sci., Peking* 1959 (5), (370–80). 6 refs. [Chin. russ.]

Discusses the importance of shelterbelts in the region, and the types best suited to various situations (illustrated), and tabulates, with Latin names, the timber and fruit trees, shrubs, grasses etc. recommended for the different zones.

3167. **[Investigations on shelterbelts in the coastal region of Hopeh Province.]** *For. Sci., Peking* 1959 (6), (417–28). 2 refs. [Chin.russ.]

Sands cover ca. 300,000 mu and solonchaks 3½ million mu in the region. Tree species that can withstand various degrees of soil salinity are discussed, especially *Amorpha* [*fruticosa*] which is the most salt-resistant and can be grown at soil salt contents of $\leqslant 2\%$. Measures to assist shelterbelt establishment, dune fixation, and salt removal by leaching are outlined.

3168. ĖRPERT, S. D. Opyt polezaščitnogo lesorazvedenija na počvah soloncovogo kompleksa. **[Shelterbelt planting trials on soils of the solonetz complex.]** *Trud. Inst. Les.* No. 38, 1958 (21–40). [Russ.]

Discusses the results of plantings started in 1951 in the Cis-Caspian semi-desert, with *Quercus robur*, *Ulmus pumila* var. *arborea*, *Fraxinus pennsylvanica*, *Tamarix* sp., *Elaeagnus angustifolia*, *Lonicera tatarica* and *Ribes aureum*. Special attention is paid to root-system development. Three-row plantings (tree, shrub, tree) were made in the fields themselves, to collect winter snow. The best orientation was N.–S. The strips should be $\ngtr$ 75 m. part, with plants 0·75–1 m. apart in rows $\nless$ 1·5 m. apart. *U.p.* var. *arborea* was the most successful tree species, but *Q. robur* should be used on the better soils.

3169. KRAEVOJ, S. JA., *et al.* K razrabotke sposobov vyraščivanija zaščitnyh polosnyh lesonasaždenij na Ergenah. **[Working out methods of growing shelterbelts in the Ergeni Hills.]** *Trud. Inst. Les.* No. 42, 1959 (11–66). 79 refs. [Russ.russ.]

Reviews work at the Arshan-Zelmensk station since 1950 on shelterbelt establishment in connexion with the Stalingrad–Elista–Cherkessk State Shelterbelt, part of which runs through the Ergeni Hills. The following general conclusions are drawn: deep ploughing and the creation of snow-collecting barriers and furrows help to increase the soil m.c.; planting should be done only when supplies of water in the top 2 m. of soil are equivalent to 50–60 cm.; inter-row harrowing should be done for the first four years; root development is much better on deeply ploughed soils; distances between rows should be 3–4 m.; *Ulmus pumila* var. *arborea*, *Robinia pseudoacacia*, *Lonicera tatarica*, *Quercus robur* and *Ribes aureum* are among the most suitable species for shelterbelts in the area.

3170. KRAEVOJ, S. JA., *et al.* O zaščitnoj i podgonočnoj roli kulis iz kustarnikov i vysokostebel′nyh sel′skohozjajstvennyh rastenij dlja duba čereščatogo. **[The role of strips of shrubs and tall farm crops in protecting and accelerating [the growth of] *Quercus robur*.]** *Trud. Inst. Les.* No. 42, 1959 (67–97). 9 refs. [Russ.russ.]

Trials in the Ergeni Hills showed that strips of maize and sorghum 4·4 and 3·4 m. wide, alternating with corridors 1·6 and 2·6 m. wide respectively for lines of young Oak, were unsatisfactory because the grain competed too much for soil moisture; but grain strips 2·4 m. wide with corridors 3·6 m. wide were satisfactory. Oaks growing between sparse strips of grain frequently showed chlorotic yellowing in hot spells. Oak between strips of sheltering *Elaeagnus angustifolia* and grain attained mean heights of 1·5 m. in 5 years—better than in the open. Maize yields from the 2·4-m. strips were 1200 kg./ha. Three-row strips of *E. angustifolia* planted one year before the Oak was sown, also gave good protection.

3171. ZEMLJANICKIJ, L. T. Vlijanie lesnyh polos na povyšenie plodorodija soloncevatyh kaštanovyh počv. **[The influence of shelterbelts on the increase in fertility of solonetz-type chestnut soils.]** *Vestn. sel′.-hoz. Nauki, Moskva* 4 (12), 1959 (65–70). 3 refs. [Russ.e.g.f.] O.W.

Conclusions are drawn from many years of investigations in the S.E. of the U.S.S.R. [cf. *F.A.* 16 No. 3735; 17 No. 25; 18 Nos. 196, 439] on the desalinization of the top 1 m. of saline chestnut soils of fields protected by shelterbelts aged 12–15 years. Soil improvement is greatest up to distances from the belts of 10–15 times their height. The part played by leaf-fall and snow retention in this improvement is discussed.

3172. VLASOV, S. I., and ZAJCEV, N. M. Zaščitnye lesonasaždenija v orošaemyh uslovijah Prikaspijskoj nizmennosti. **[Shelterbelts in the irrigable areas of the Cis-Caspian lowland.]** *Trud. Inst. Les.* No. 42, 1959 (98–131 + 1 dgm.). 10 refs. [Russ. russ.]

Discusses experiments with the object of working out an irrigation schedule for plantations, and choosing the best type of mixed plantations for the solonetz-type soils of the area. Data are given on furrow irrigation, the change in the chemical properties of the soil as a result of irrigation, and the influence of various irrigation schedules on the growth of *Quercus robur*, *Ulmus pumila* var. *arborea* and *Rhus cotinus*. The best schedule was that which kept soil m.c. at 70–100% of field capacity; in the 1st and 2nd years of the plantation this required 3500–4000 cu.m. water/ha., and in the 3rd and 4th years 4000–5000 cu.m./ha. *U.p.* var. *arborea* grew well on (1) light-chestnut solonetz-type soils, and (2) solonetz soils themselves, provided soil m.c. was $\nless$ 60% of field capacity. Oak and *R. cotinus* did very well on (1), but not on (2), where lucerne should be sown first. Inoculation with mycorrhizal fungi greatly improved the growth of Oak. Rows of trees should be 3–3·5 m. apart.

3173. Čajanov, S. K. Poluvekovoj opyt v oblasti polupustyni. **[Fifty years of experiments in the semi-desert region.]** *Izv. Akad. Nauk SSSR* (*Ser. biol.*) 1959 (5), (698–713). 6 refs. [Russ.russ.e.] A.P.B.

An account of changes in soil, vegetation and crop yields in the 50 years since the Temir (now Aktyubinsk) agricultural experiment station was set up in 1907 in the virgin semi-desert of Kazakhstan. During the period the climate has become drier and hotter, and there has been a general worsening in conditions in the virgin lands. However, where shelterbelts were planted and a rational system of agriculture introduced, yields of grain have increased fourfold, and light-chestnut soils have become dark-chestnut and their humus content has increased.

3174. Woodruff, N. P., Read, R. A., and Chepil, W. S. **Influence of a field windbreak on summer wind movement and air temperature.** *Technical Bulletin, Kansas Agricultural Experiment Station, Manhattan* No. 100, 1959. pp. 24. 14 refs.

Reports on measurements at heights up to 40 ft. to the leeward (north) of a windbreak ¼ mile long, 10 rows deep, and, at 16 years, 20–25 ft. high, year Lyons, Kansas (species and their survival rates given). Results, indicating reductions in wind speed of $\geqslant$ 50% for 4–8 tree heights ($H$), to leeward, 20% for $20H$, and 5–7% for $43H$, with considerable turbulence to $10H$, confirm earlier findings. Temperature effects were highly complex, with a zone of higher values than in the unsheltered open, varying with height above ground and time of day, followed by a zone with lower values. Evapotranspiration as computed by Jensen [see *F.A.* 16 No. 1756] was reduced in a zone from 2·2 to $12H$, with a midday maximum reduction of 20% at 8·6$H$. [Cf. *F.A.* 17 No. 2808.]

### 268. Pastured Forests. Grazing on Forest and Open Ranges. Forage Plants etc.

See also Nos. 2630, 2678, 3114, 3291 *et seq.*, 3904.

3175. Matsui, Z., Yokoyama, C., and Matsuzaki, S. **[Sheep grazing in the natural forest or planted stand.]** *Extr.* from *Ann. Rep. For. Exp. Sta., Hokkaido 1958*, 1959 (121–30). [Jap.jap.e.*e.*]

Presents data on the relative amounts of different vegetation (palatable herbs, non-forage herbs, trees and shrubs, runners and vines) eaten by sheep in summer grazing, in (*a*) mixed Ash and Alder natural forest and (*b*) a White Pine [*Pinus strobus*] stand. [Cf. *F.A.* 21 No. 504.]

3176. Ehrenreich, J. H. **Releasing understorey Pine increased herbage production.** *Sta. Note Cent. St. For. Exp. Sta.* No. 139, 1959. pp. 2. 2 refs.

Reducing the Oak crown cover from 90–95 to 20–30% by hand spraying with 2,4,5-T in fuel oil increased herbage production 5–6 times for at least 3 years, while after aerial spraying production increased 17 times in the first year, but, with the rapid growth of the released Pine and hardwood regrowth, fell slightly below that of hand-sprayed areas in the second and third years [cf. *F.A.* 14 No. 352].

3177. Denham, A. **Compatibility of grass and trees on east-side Oregon and Washington forests.** *Proc. Soc. Amer. For. 1959*, 1960 (164–6). 6 refs.

Calls for improved logging methods on multiple-use land (present tractor logging destroys 25–30% of herbaceous and shrubby vegetation), and sowing grass after logging, to maintain range values and prevent erosion.

3178. Sowder, J. E. **Seeding grass on areas disturbed by logging or fire on east-side Oregon and Washington forests.** *Proc. Soc. Amer. For. 1959*, 1960 (166–8). 9 refs.

Reviews briefly the problem of producing more timber and more forage on Ponderosa Pine land.

3179. Sampson, A. W. **California brushlands—their characteristics and utility.** *Proc. Soc. Amer. For. 1959*, 1960 (173–80). 27 refs.

A description of the plant associations of California's 20 million acres of brushland, with notes on the nutritive value of browse species.

### 27. Arboreta. Arboriculture for Ornamental Purposes. Hedges and Hedge Plants

See also Nos. 2983, 3254.

3180. Ferré, Y. de, and Gaussen, H. Histoire de l'Arboretum de 1952 à 1957. **[History of the Arboretum [of Jouéou] from 1952 to 1957.]** *Trav. Lab. For. Toulouse* 1 (4), Art. 6, 1959 (99–130). [F.]

Principally an account of the growth of exotic conifers.

3181. Philippis, A. de. Note sur le Populetum méditerranéen. **[The Mediterranean Populetum.]** [*Docum.*] *10th Sess. Int. Poplar Comm., Italy 1959* No. *FAO/CIP* 98 *Add.* 1, 1959. pp. 5 + 5 tbls. [F.]

Contains lists of Mediterranean and Near East clones cultivated, recent additions, and growth data on plants established in 1958 and '59 in the Rome and Battipaglia (Salerno) Populeta.

3182. Bugała, W. Kolekcja topoli w Arboretum Kórnickim. Część III. **[The Poplar collection at the Kórnik Arboretum. III.]** *Arboretum Kórnickie, Poznań* No. 4, 1959 (123–63). 26 refs. [Pol.russ. e.*e.*]

The collection contains 12 species and 12 hybrids in Section *Tacamahaca*, and 3 species in Section *Leucoides*. All are described with notes on performance.

3183. Browicz, K., and Bugała, W. Rzadkie drzewa i krzewy w Arboretum Kórnickim. **[Rare trees and shrubs in the Kórnik Arboretum.]** *Arboretum Kórnickie, Poznań* No. 4, 1959 (165–81). 12 refs. [Pol.russ.e.*e.*]

[Cf. *F.A.* 21 No. 506.] *Aucuba japonica*, *Cercidiphyllum magnificum* (30 years, 10 m. high, and very healthy and hardy), *Amelasorbus* × *jackii*, and *Stachyurus chinensis*.

3184. KOMAROV, I. A., *et al.* Derev′ja i kustarniki. Kratkie itogi introdukcii v glavnom botaničeskom sadu Akademii Nauk SSSR. **[Trees and shrubs. Brief results of their introduction in the principal botanic garden of the U.S.S.R. Academy of Sciences.]** Izdatel′stvo Akademii Nauk SSSR, Moscow. 1959. pp. 190 + 2 coloured plates. [Russ.]

Presents an annotated list of 970 Russian and foreign species and varieties of woody plants, giving data on their dimensions, development, and winter hardiness under Central (European) Russian conditions, their natural distribution, and date and form (i.e. as seed, seedling or sapling) of introduction. Alphabetical indexes of Russian and botanical names of families, genera and species, and a table showing the annual additions to the collection (1937–58) are included.

3185. SCHMITZ, A., and MISSON, A. Catalogue de l'Arborétum de l'Étoile, Élisabethville (Congo belge). **[Catalogue of the Arboretum de l'Étoile, Élisabethville, Belgian Congo.]** *Publ. Comm. Spéc. Katanga* No. 15*B*, 1959. pp. 249 + 21 plates, 2 plans. 6 pp. of refs. [F.]

3186. **[Centenary number.]** *Gdns. Bull.* 17 (2), 1958 (1959). pp. 340 + 9 plates.

Includes the following: History and functions of botanic gardens with special reference to Singapore (*J. W. Purseglove*); Kew and Singapore (*T. A. Russel*); Singapore and Flora Malesiana (*C. G. G. J. van Steenis*); Singapore and Leiden (*H. J. Lam*); A note on the Gardens jungle (*I. H. Burkill*); The Singapore Botanic Gardens and forestry in Malaya (*J. Wyatt-Smith*); The Singapore Botanic Gardens and rubber in Malaya (*P. R. Wycherley*); Orchids, ginger and Bamboos: pioneer work of the Singapore Botanic Gardens (*R. E. Holttum*); Singapore's contribution to the study of Palms (*C. X. Furtado*); The Botanic Gardens and conservation in Malaya (*H. M. Burkill*); Role of botanical gardens in the humid tropics (*L. Mattsson*).

## 28. Husbandry of Forest Products Other than Wood

### 282. Bark Crops

See Nos. 2766, 2815, 3290, 3519.

### 283. Fruit and Seed Crops etc.

See also No. 3929.

3187. LIN, W.-C., *et al.* **[An investigation and study of Chinese Tallow Tree in Taiwan (*Sapium sebiferum*, Roxb.).]** *Bull. Taiwan For. Res. Inst.* No. 57, 1958. pp. 37 + 4 tbls. 23 refs. [Chin.*e.*]

Botanical features, distribution in Formosa, sites, climate, cultivation, growth rate, seed yields (of both the eagle's-claw and grape types of *S. sebiferum*, the latter being the better), contents of vegetable tallow and oil, and the physical characteristics of the tallow and oil. Much tabulated data is given in the 6-page English summary.

3188. HSÜ, C.-K. **[Some problems in Tea oil [*Camellia sasanqua*?] cultivation.]** *For. Sci., Peking* 1958 (4), (392–8). [Chin.]

A general account from Chinese experience, describing, with illustrations, development from the seed and re-shooting from the rootstock, and discussing choice of planting site, preparation of site for sowing or planting, selection of seed, season for sowing and planting, and tending.

### 284. Crops Tapped for Exudations etc.

See also Nos. 3668–9, 3878, 3881, 3884.

3189. MATHAUDA, G. S. **Influence of method of fixing resin lips on resin yields from Chir Pine (*Pinus roxburghii* Sargent).** *Indian For.* 86 (1), 1960 (18–20). 3 refs.

Results of two experiments on the comparative merits of nailed vs. wood-inserted lips are presented. Data collected in the course of this work show that nailed lips give respectively 11 and 18% better yield during the first and second years' tapping of new channels. No significant difference in yield was found from faces on the E. and W. sides of trees. *From author's summary.*

3190. PENTEGOV, A. P. K voprosu o kompleksnom ispol′zovanii kedrovyh lesov v SSSR. **[Rational utilization of the *Pinus sibirica* forests of the U.S.S.R.]** *In* 'Sbornik Statej po Resul′t. Issled. v Oblasti Lesn. Hoz. i Lesn. Prom. v Taežnoj Zone SSSR'. Moscow. 1957. pp. 275–84. 10 refs. [Russ.]

Discusses the oleoresin distribution, labour requirement in tapping, influence of tapping on increment and cone-bearing, the composition and properties of the oleoresin and by-products and resin acids of the oleoresin. Makes suggestions for research on, and management of *P. sibirica*.

### 287. Bamboo and Cane Growing etc.

3191. SETH, S. K., and MATHAUDA, G. S. **Bamboo experiments.** *Indian For.* 85 (12), 1959 (699–709).

Discusses desirable lines of research and possible techniques, and suggests lay-out and design for experiments to determine e.g. best methods of regeneration, optimum cutting cycles and intensities.

3192. MATHAUDA, G. S. **Relation between new culm production and the number of old culms in Bamboos and its bearing on national Bamboo management.** *Indian For.* 86 (2), 1960 (58–69). 2 refs.

Extensive data (tabulated) for *Dendrocalamus strictus* in several areas indicate a wide variation in the number of new culms produced in different years and for different sizes of clump. More limited data on other Bamboos suggest that the same is true of them. It is concluded that controlled fellings of Bamboo must be based on annual production over a large number of years and not, as at present, for one or two seasons only.

## 3. WORK SCIENCE (WORK STUDIES). HARVESTING OF WOOD: LOGGING AND TRANSPORT. FOREST ENGINEERING

3193. WETTSTEIN, E. **Report to the Government of Turkey on logging and forest road construction.** Expanded Technical Assistance Program, FAO. *FAO* No. 1153, 1959. pp. 35. Limited distribution.

Emphasizes the need for training of forestry staff in practical work. A note on skyline systems and an illustrated list of recommended logging tools (no power saws) is included.

### 30. Work Science (Work Studies): General

See also No. 3922.

3194. KILANDER, K. **Work studies in Swedish forestry.** *Publication, Forskningsstiftelsen SDA, Stockholm* No. *TO*: 12, 1960. pp. 28. 9 refs. [E.]

Discusses the purpose of work studies in forestry, their uses, and methods used.

3195. KILANDER, K. **Work studies in forestry. Time studies without correction to normal work output.** *Pulp Paper Mag. Can.* 61 (1), 1960 (132–3, 136–7). 7 refs.

A general discussion, based on SDA work [cf. *F.A.* 16 Nos. 499–501], including the costing system in forestry, time studies, performance level, costing of new working methods, etc.

### 304. Hygiene. Safety; Accidents and their Prevention

3196. MEYR, R. Unfallverhütung bei Seilbringungsarbeiten. **[Preventing accidents in cable skidding.]** *Allg. Forstztg.* 70 (3/4), 1960: *Suppl.* (*Informationsdienst* No. 29). pp. 2. [G.]

Covers ground and aerial skidding, discussing hazards arising from sudden movements of taut cables, breaking of cables, lightning, etc. and stressing the need for careful training and a good signalling system.

### 305. Sequence of Work and Performance (Time and Performance Tables, Evaluation of Work)

See also Nos. 2969, 3008, 3154.

3197. GEIGER, F. Steigerung der Arbeitsproduktivität im Staatswald Nordwürttembergs von 1953 bis 1958. **[The rise of productivity in the State forests of N. Württemberg, 1953–58.]** *Allg. Forstzeitschr.* 15 (12), 1960 (173–5). 2 refs. [G.]

Presents data in terms of quantity of work performed per hour. The greatest advance (110%) was in planting, due to the introduction of Reissinger's method [cf. *F.A.* 21 No. 2969], followed by fencing (100)%; the smallest was in logging (12% on piece work, 20% at time rates). Mean rise was 6% p.a., against 7% for German industry as a whole. The rise of productivity has largely compensated for the contraction of the labour force and increased wages. Possibilities for raising it further through mechanization and improved organization are discussed, including concentration of logging at fewer sites, formation of landings, more mechanization in larger but fewer nurseries, etc.

### 307. Tools, Equipment, Machines and Working Animals: General

See also Nos. 2935, 2969, 2998–3003, 3007–8, 3010, 3030, 3046, 3254, 3282–3, 3286–7, 3296.

3198. Stand und Entwicklung der Forsttechnik in der DDR. **[Forest mechanization in E. Germany.]** *Suppl.* to *Forst u. Jagd.* Ministerium für Land- und Forstwirtschaft, Berlin. 1958. pp. 48. [G.]

Contains papers of a conference in 1957, including articles on (1) the Institut für forstliches Ingenieurswesen, Tharandt by its director *E. E. Stentzel*; (2) the Institut für Forsttechnik, Menz-Neuroofen, by its director *H. Achilles*; and (3) the Institut für forstliche Arbeitslehre und Technik, Eberswalde, by its director *F. E. Hache*; with particulars of their staffs, main sections, and research programmes. The notes on research programmes include the development of machinery and of optimum working methods and organization, nursery work, logging in Pine and Beech, conversion on large landings etc. There are also illustrated descriptions of equipment (some being prototypes), including a pulpwood barking machine on rubber-tyred wheels, and an all-purpose portable internal-combustion engine with attachments such as chain-bowsaw with a 20-cm. cutting span for thinning and pruning, a circular pruning saw, and a rotary cutter for cutting resin-tapping faces, the last two being electrically driven from a low-voltage generator worked off the engine.

3199. Informations sur le matériel. **[Equipment news.]** *Bois For. Trop.* No. 68, 1959 (74–8). [F.]

Describes, with specifications and photographs: the 'RCM Clearer', a heavy disk-plough manufactured by the Société Rethéloise de Constructions Mécaniques; and the 'Remorque S.I.B.E.', a heavy trailer for the transport of logs in the tropics, manufactured and used by the Sté Industrielle et Commerciale de Mécanique de la Côte d'Ivoire.

3200. Informations sur le matériel. **[Equipment news.]** *Bois For. Trop.* No. 69, 1960 (76–80). [F.]

Describes and illustrates: a girdling tool (Canadian Pulp & Paper Ass.); the series F Log Stacker, which handles > 2000 cu.m. per day, and type FT Stacker, a reduced version of series F with 3 instead of 4 wheels and a lifting capacity of 15 tons vs. 22 for type F (R. G. Letourneau, Longview, Texas); and a 6-ton lighter with shallow draught and flat bottom suitable for river or port use (Ateliers et Chantiers de l'Afrique Equatoriale, Libreville, Gabon).

### 31. Logging and Transport: General

See also No. 3917.

3201. MEYR, R. Forstliche Arbeits- und Transporttechnik in Norwegen. **[Working and transport methods in Norway.]** *Allg. Forstztg.* 71 (5/6), 1960 (49–53). [G.]

Illustrated description of a study tour including equipment for road-building and draining, logging, floating, barking, cableways etc. A gun for shooting a thin nylon line over distances up to 300 m. as an aid to setting up skyline cables is briefly described.

3202. Ericksen, L. N. **Progress in logging 1959.** *For. Prod. J.* 10 (2), 1960 (57–62). 56 refs.

Equipment briefly surveyed includes the Bombardier processing unit, consisting of a trimming tool, cable conveyor, slasher, and disposal unit, which converts whole trees into 4-foot bolts, ready stacked on pallets; the Muskeg tractor, developed from the Snowmobile [cf. *F.A.* 17 No. 1663], fitted with 4 sets of rubber-tyred wheels on each side, around which runs a belt-type track of nylon and rubber, designed for use on snow, muskeg and steep terrain, and available either with boom and spar, or with a tilting platform; the Pugh Ridge skyline etc.

3203. Soetopo [Sutopo], M., Tedjokoesomo [Tedjokusomo], R. H., and Dijen, A. M. Pemungatan dan ekspor hasil hutan di North Borneo. **[Forest exploitation and export of forest products in North Borneo.]** *Rimba Indonesia* 8 (3/4), 1959 (101–51 + 1 map). 17 refs. [Jav.e.]

A report by a three-man mission appointed by the Indonesian Ministry of Agriculture to study mechanization of logging and exports. Recommendations are made on yarding distances, logging railways and roads, loading and unloading equipment and harbour installations for Indonesian conditions. *From authors' summary.*

## 32. Felling and Related Operations

### 321. Marking

See No. 3216.

### 323. Felling and Subsequent Primary Conversion

See also Nos. 3207–15.

3204. Popović, V. Racionalna podela debla u eksploataciji šuma. **[Rational division of the stem in forest exploitation.]** *Glasn. Šum. Fak., Beograd* No. 14, 1958. pp. 77. 6 refs. [Serb.g.]

Discusses, from the mathematical aspect, the problems of cross-cutting logs to give either maximum volume utilization or maximum financial returns.

## 33. Degree of Utilization and Waste. Clearing the Felling Site. Harvesting of Small Wood. Salvage Fellings

See also Nos. 3228, 3526, 3838, 3917.

3205. Kiščenko, T. I. Racional'nye sposoby očistki lesosek. **[Rational methods of clearing felling areas.]** *Lesn. Prom.* 1960 (1), (10–2). [Russ.]

Describes two methods: (*a*) in full-tree logging, where most of the branches are taken to the landing and burned or utilized there and the ones broken off in skidding are left on the felling site; (*b*) in tree-length logging, where all branches are placed on the tractor skidding trails and are flattened into the earth by the tractors during skidding. Method (*a*) cost ca. $\frac{1}{2}$, and (*b*) ca. $\frac{1}{3}$, of the cost of conventional clearing (by gathering the waste into piles and burning it).

3206. Komšilov, N. F. K teorii obrazovanija i sozrevanija pnevogo osmola. **[Theoretical aspects of the formation and maturation of resinous wood in Pine stumps.]** *In* 'Sbornik Statej po Rezul't. Issled. v Oblasti Lesn. Hoz. i Lesn. Prom. v Taežnoj Zone SSSR'. Moscow. 1957. pp. 265–74. 19 refs. [Russ.]

Discusses literature, and tabulates data on the composition of resinous wood of *Pinus sylvestris*, with reference to possible means—especially barking the stumps—of hastening the process of resin-soaking and conserving the resin.

3207. Weissgerber, H. Arbeitstechnik in der Nadelholz-Durchforstung. **[Working techniques in thinning conifers.]** *Forst- u. Holzw.* 15 (3), 1960 (50–1). [G.]

Describes a method of thinning (2-man team, one man with a power saw, the other with axe and calipers + scribe) which has proved economically satisfactory, despite the often-voiced fears of the unsuitability of power saws for thinning in conifers.

3208. Vannby, K.-G. Några reflexioner över minsta toppdiametern. **[Minimum top diameters.]** *Skogen* 47 (2), 1960 (36–7). [Sw.]

Presents figures showing the effect of d.b.h. and top diam. on thinning time, and of d.b.h. and the height of the bolt in the tree on the combined time for felling and primary conversion of Pine thinnings. Mean cost of these, for all dimensions together, was Kr.8.14/cu.m., whereas for the smallest trees (d.b.h. 11 cm.) it was Kr.11.40, and for the top log Kr.16. With the present adequate supply of timber (in 1959 < 50 million cu.m. was felled compared with an increment of ca. 70 million), an increase in the minimum top diameter and a corresponding increase in the number of trees felled, i.e. an intensification of thinning, is recommended.

## 34. Storage of Wood in the Forest and at Log Dumps ('Landings')

See Nos. 3796, 3798, 3800–1.

## 35. Performance Measurements for Determining Piece Rates in Felling and Related Operations

See also No. 3244.

3209. Putkisto, K. Pinotavaran tekijäin työskentelyjärjestelmän analysointia. **[Analysis of the working method of cordwood loggers.]** *Metsät. Aikak.* 1959 (9; 10), (298–306, 317; 329–32). 17 refs. [Fi.e.]

Two methods, making the cordwood (*a*) at the side of strip roads and (*b*) in dispersed formations [cf. *F.A.* 21 No. 1861], were compared. Formulae were derived from a theoretical basis and their results compared with actual ones from an operation in which 500 stacked cu.m. were felled and stacked, 63% according to (*a*) and 37% according to (*b*), by 7 men on snow-free ground. The chief points studied were the location of the stacks in relation to marked trees, felling direction of the trees, directness of route in moving the bolts, and location of stacks in relation to the weight of the bolts to be moved. In both methods, work proved to be badly organized and the unnecessary distance over which bolts were moved averaged ca. 200 m./stacked cu.m. A substantial increase in output should be possible with proper planning. *From author's summary.*

### 36. Tools, Machines and Equipment for Felling and Related Operations

See also Nos. 3007, 3010, 3157, 3198, 3201–2, 3207.

3210. VORONYTSIN [VORONICYN], K. **Russians boost timber harvest.** *Timberman* 61 (2), 1960 (34–6, 84).

A general illustrated account of Soviet logging equipment (both mass-produced and experimental machinery) by the Director of CNIIMĖ.

3211. BERKEL, A. Yerli ağaç türlerimizde çift kollu orman destereleri ile çalışmada iş verimi denemeleri. **[Investigations on the rate of sawing some Turkish timbers with two-man cross-cut saws.]** *Istanbul Üniv. Orm. Fak. Derg.* 9*A* (1), 1959 (22–30). 4 refs. [Turk.g.*g.*]

Tabulates data on the area cut per min., area cut per double stroke, and number of double strokes per min. in cross-cutting *Quercus sessiliflora*, *Fagus orientalis*, *Castanea sativa*, *Carpinus betulus*, *Alnus glutinosa*, *Pinus nigra* var. *caramanica*, and *P. pinea* logs. The saws used were 1·4 m. long, and of different design for hardwoods and softwoods.

3212. JANČO, J. Technická charakteristika jednomužných ret'azových pil. **[The technical characteristics of the one-man chain saw.]** *Sborn. Čsl. Akad. Zeměd.* (*Lesn.*) 5 (9/10), 1959 (953–66). 1 ref. [Slovak.slovak.russ.g.]

Stresses the need for more basic research on chain saws (their metals, sawing speeds etc.), on improved design, development and production, and wider practical use, in view of the superiority of foreign over Czechoslovakian saws (tabulated performance data compared for 2 Czechoslovakian, 1 Russian, 2 Swedish, 1 Norwegian and 4 U.S. saws).

3213. OEHRLI, J. W. **Dynamometer tests on cutting action of chain-saw teeth.** *For. Prod. J.* 10 (1), 1960 (4–7). 1 ref.

Describes tests with various chain-saw cutter teeth mounted on a 38-in. circular disk with a dynamometer, supplemented by studies on an experimental rig resembling an over-size chain-saw. The specimens used were Ponderosa Pine saw cants, 12 × 12 in. × 2–3 ft., at 15–40% moisture content. Factors tested included cutting-tooth speed, feed rate, cutter shape, kerf width, and ripping vs. cross-cutting. Each type of cutter was shown to have an optimum bite (the theoretical thickness of each chip before it is actually formed) independent of the wide variations in cutting-tooth speed, feed rate, and power available. For each speed, optimum bites resulting in maximum cutting rates occurred at a different feed rate. Cutting efficiency decreased with decreasing bite. Feed pressure requirements were lowest with moderately high cutter speeds. Vibration, which changed the path of the cutter, was extremely wasteful of power. Chain-cutter action was affected by the mass of the supporting guide-plate. Cutting efficiency rose when 'thinner' cutting edges (larger cutting angles) were used.

3214. STREHLKE, B. Ergebnisse von Motorsägenuntersuchungen. **[Results of power-saw investigations.]** *Holz-Zbl.* 85 (156), 1959 (2089–91). 15 refs. [G.g.]

Reports on studies at Hann. Münden, in the laboratory and field, on sawing techniques and the performance and running costs of various types of one-man power saws. Chief results were: In mature Spruce (mean d.b.h. 46 cm.), using a saw with a 45-cm. guide-plate, felling time was reduced by a third if root swellings were cut off after, instead of before, the main felling cut. Cutting time, particularly for cordwood, was markedly less for conversion at a landing after whole-tree skidding than at stump. Direct (gearless) saws (*a*) proved superior to geared ones (*b*) in rate of cutting (sq. cm./min.) and in performance per unit of saw weight, but inferior in performance per unit of h.p., except with diameters $\leqslant$ 15 cm. For both types, rate of cutting with Beech was ca. 75% of that with Spruce. For both, rate of cutting was highest for diameters of ca. 25 cm., (*a*) having a second peak for very small diameters; mean fuel consumption was 1·8 litres/hour for (*a*) and 1·3 for (*b*), but varied considerably with makes and conditions, and also operator. Costs per hour for (*a*) were slightly higher than for (*b*), but in terms of cross-sectional area cut, costs were about equal for the cheaper (*a*) models.

Tests of chain speeds with an adjustable (*b*) saw showed lowest performance and greatest physical strain at 7 m./sec. with Spruce and Beech, but little, and no clear-cut, difference, between 10 and 15 m./sec. Preliminary tests on a special automatic recording apparatus indicated a sharp increase in friction after 15 m./sec., and also with excessive chain tensions. Blunting was rapid, reducing performance from ca. 3000 sq. cm./min. to ca. 1500 after 3 sq. m. in a test on dry Spruce.

3215. PLATZER, H. B., and SACKEL, W. Theorie und Instandhaltung der Spitz-(Reisser-) Zahnkette. I. II. **[Theory and maintenance of the cutter-raker saw chain. I. II.]** *Forst- u. Holzw.* 14 (20; 21), 1959 (429–32; 449–53). 8 refs. [G.g.]

[Cf. *F.A.* 20 No. 1881.] Describes some commercial makes of chain with cutter-raker saw teeth, and their maintenance, and discusses their development.

3216. LESLIE, R. E., and PATTON, W. M. **A wire method of marking trees for long term identification.** *J. For.* 58 (2), 1960 (120–1).

Trees can be marked permanently by driving 30-in. lengths of stiff galvanized steel wire almost vertically to a depth of ca. 1 in. into the root-collar area with a hammering device made from 28 in. of iron piping. A quiver made from discarded fire hose carries ca. 100 wires. Cost per wire is 1½ cents, including dipping the top end in yellow paint for easier identification. Since the wires were first used in 1956, the only noticeable damage to trees is a slight stain-streak in the sapwood, extending < 5 in. above the point of insertion. This is well below stump height. Wires have not deteriorated.

## 37. Transport

See also Nos. 2708, 3193, 3210, 3924.

### 372/377. Land Transport

See also Nos. 3196, 3198–3203, 3512, 3607, 3614, 3922.

3217. Salminen, J. Kokeiluja ohutpuunippujen hankinnasta. [**Experiments on logging of bundles of small-sized timber.**] *Tied., Metsäteho, Helsinki* No. 169, 1960. pp. 27. [Fi.e.*e.*]

Presents data, derived from different districts, on the saving in time and cost from bundling small timber. Concludes that the maximum saving occurs when logs are bundled before long-distance hauling. The bundles are too small to be economic when bundling is done before skidding. *From author's summary.*

3218. Korobov, G. B., *et al.* Mehanizirovannaja pogruzka korot′ja v krytye vagony. [**Mechanized loading of short logs into covered [railway] wagons.**] *Lesn. Prom.* 1960 (1), (4–6). [Russ.]

Describes, with specifications and illustrations, a hydraulically-operated 'bucket' grab (130 × 75 × 90 cm.) fitted to the forks of a standard fork-lift truck, and developed specially for handling pulpwood and other small roundwood.

3219. Lepitre, C. Grue à béquilles. [**A tripod crane.**] *Bois For. Trop.* No. 69, 1960 (33–45). 2 refs. [F.e.span.]

Discusses from field observations the working efficiency of the crane (a jib crane with two adjustable wooden props, mounted on a lorry), which can load a lorry in 30 min., or in < 20 min. if the load (mean volume 13·5 cu.m.) is assembled on the ground by a 'service tractor'. Though this tractor is the main item in the cost of loading by the crane (100–160 out of 180–240 Fr./cu.m.), it gives flexibility in organization; loads can be prepared in advance, or at times when a tractor would otherwise be idle, independently of the actual loading operation. The mobility of the crane allows loading in the most convenient place. The possibility is discussed of increasing its lifting capacity from 20 to 25 metric tons. One means would be to replace the wooden props, whose strength and manageable length are a limiting factor, by tubular metal ones. Diagrams illustrate the principles involved. [Cf. *F.A.* 16 No. 4122.]

3220. Korhonen, L. Vaihtolava pinotavaran autokuormauksissa. [**The use of replaceable platforms when loading stacked wood on to lorries.**] *Metsät. Aikak.* 1959 (10), (349, 361). [Fi.e.]

The use of the platforms [illustrated] reduces the time taken to load the lorry from 1–2 hours to 10 min., thus considerably increasing the latter's output. No help is needed on the lorry, but a loader loads the empty platform while the lorry carries the full one to the unloading point. Timber hauled out by horses can be loaded direct on to the platforms. *From author's summary.*

3221. Singh, N. **Wire-ropes—description and maintenance.** *Indian For.* 86 (1), 1960 (33–6). 3 refs.

3222. Réman, Z., Schlaghamersky, A., and Dressler, M. Použité umělých podper u lesních lanových drah. [**The use of supports in forest cableways.**] *Sborn. Čsl. Akad. Zeměd.* (*Lesn.*) 5 (9/10), 1959 (879–908). 17 refs. [Cz.cz.russ.g.]

Describes, and theoretically examines the construction of, a range of supports (derricks, gyns, A-frames, etc.) with particular reference to their use with various cableways and under different forest conditions in Czechoslovakia.

3223. **Radio-controlled logging may solve problem of harvesting rugged terrain.** *Timberman* 60 (12), 1959 (44–6).

Illustrated description of a radio-controlled skyline logging system at Mt. Baker, Wash. The carriage, which runs on the skyline, incorporates a diesel engine, a torque converter, and a small winch for hauling the load up to the carriage, its action being radio-controlled from the ground by the head chokerman and also by the engineer at the landing. The position and speed of the carriage is at all times controlled by the engineer on the ground winch. The system has successfully yarded logs over a distance of 5000 ft., and can take loads of 35,000 lb. Details are given of the most important pieces of equipment.

3224. Schippel, H. R. Vinschtransport. [**Logging by winch.**] *Skogen* 47 (4), 1960 (77–8, 85). [Sw.]

Working speeds and costs with a tractor-mounted Isachsen two-drum winch [cf. *F.A.* 18 No. 1692] were 2·88 cu.m./hr. and Kr.6·54/cu.m. (Kr.9.50 for horse skidding) in clear felling for timber and 3- and 4-m. pulpwood, and 4.08 cu.m./hr. and Kr.4.62/cu.m. (Kr. 7 for horse skidding) for thinning. In a small-scale experiment with the Sepson radio-controlled one-drum winch [cf. *F.A.* 20 No. 4663], working speed was 1.49 cu.m./hr. and cost Kr. 5.81/cu.m. (Kr.12 for horse skidding). All the logging sites were on difficult ground, the last being in a ravine with a slope of 1/2. All costs quoted are machine cost (operating costs plus amortization, etc.) plus labour cost.

3225. Degermendži, P. A. Trelevočnaja lebedka s turboperedačej. [**A skidding winch with turbo-transmission.**] *Lesn. Prom.* 1960 (1), (21–3). [Russ.]

Discusses the advantages of turbo-transmission and tabulates and graphs performance data on the superiority of a diesel-engined skidding winch with turbo-transmission over the conventional standard model.

3226. Kistenfeger, J. Rückeschlitten zur Schichtholzbringung. [**Sledges for skidding cordwood.**] *Forstarchiv* 30 (12), 1959 (246–8). 1 ref. [G.]

Discusses the essential features of skidding sledges, including brakes, and lists specifications for 6 recommended models now in production. Working procedure and conditions suitable for sledges are described. A time and work study of manual sledge operation was compared with a study using a Werner 'Zieh-Max' portable motor winch and cable to brake sledges and haul up empties. While less skidding was done when the winch was used, fewer accidents occurred and the most tiring jobs were done mechanically.

3227. SÖDERLUND, J. A. Dragkraftsbehov vid virkestransport. [**Traction power requirements for timber transport**.] *Svenska SkogsvFören. Tidskr.* 58 (1), 1960 (37–56). 1 ref. [Sw.sw.]

Supplements earlier research on horse skidding [cf. *F.A.* 19 No. 510]. On snow, a pair of sledges (with 4 runners) supporting the logs at both ends was superior to sledges supporting one end or to skidding tongs, over long distance. On bare ground, four-wheeled carts (especially with rubber tyres) proved best except on very soft or stony ground, where equipment supporting one end of the log only was preferable. A sulky fitted with tracks over small rubber-tyred wheels is considered to combine the advantages of sledge and logging wheels. It is, however, not suitable for snow. Tabulated results for all methods tested and for different surfaces are given for both sets of tests.

3228. CROWTHER, R. E. **Extraction of thinnings by horse**. *Scot. For.* 14 (1), 1960 (34–41). 1 ref.

Results (with some actual data) are discussed of work studies on horse extraction on gentle to moderate slopes with a soft peaty surface in the Border forests, and on moderate to steep slopes with a hard surface in N. Wales. It is concluded that, on difficult ground, extraction of thinnings by horse will remain competitive for many years, and that more attention should be paid to improving techniques, finding the best strain of horse, training stablemen, and developing harness and equipment.

3229. MAGNUSSEN, O. Lunneredskap på hjul. [**Wheeled skidding equipment**.] *Inform. Skogbr. Skogind. ForsknForen.* (*Transportutv.*) No. 85, 1960. pp. [8]. [Nor.]

Describes, with technical data and illustrations, the following, for use in short-distance transport by horses: (1) The MSA (Mellan- och Sydsvenska Skogbrukets Arbetsstudier) skidding carriage, comprising wooden runners, steel frame, and a pair of small wheels; (2) The VSA (Föreningen Värmlands Skogsarbetsstudier) skidding carriage comprising (*a*) 2 runners mounted with rear wheels and (*b*) the loading frame,with 2 wheels at the rear and with the front end raised and resting on (*a*); (3) The Jømna combination skidding wheels (A. Olsen, Brandval i Solør and J. Berger, Flisa), consisting of wheels mounted on the shafts, with an interchangeable bar and arch that can be mounted between them; and (4) The Skogforsøksvesens equipment for skidding bundles [cf. *F.A.* 20 No. 3245].

3230. ANDERSSON, A. Aktuella synpunkter på hästkörningsredskap: detaljkonstruktioner i moderna lunningsredskap. [**Equipment for horse haulage: details of modern skidding equipment**.] *Skogsägaren* 36 (3), 1960 (60–4). [Sw.]

Describes, with illustrations, the VSA skidding carriage [see preceding abstract], the parts of which can be variously assembled to give a sledge, small logging wheels, a sledge fitted with rear wheels or a four-wheeled logging carriage.

3231. ADÁMEK, I. Jednoosý přívěsny vuz v soustavě strojů pro stavbu a údržbu lesních cest a pro dopravu dříví. [**The [use of] two-wheeled trailers in forest road building and maintenance and in timber transport**.] *Sborn. Čsl. Akad. Zeměd.* (*Lesn.*) 5 (9/10), 1959 (925–44). 5 refs. [Cz.cz.russ.g.]

Examines theoretically the principles of weight-transfer from a hitched, 2-wheeled trailer whose axle is set to the rear of centre, to its tractor, and mentions its advantages vs. 4-wheeled trailers (ease of loading, manoeuvrability and better weight distribution on to the tractor drawbar).

3232. **The 'Flex-Trac' cross-country vehicle.** *FAO For. Equipm. Note* No. *B*.23.59, 1959. pp. 2.

A short description, with two photographs, of a vehicle manufactured by Meili, Traktoren und Greiferräderfabrik, Schaffhausen, Switzerland. A new construction principle is embodied in it: the front and rear of the vehicle may be moved vertically round a central transverse axle, and the front and rear wheels pivot independently of each other on guide arms round it. It can cross a crater or ditch with sides at angles of 45°, drive along a hillside, turn in its own length, or climb over vertical walls.

3233. HELMERS, U., SÖDERLUND, J. A., and WICKSTRÖM, R. Hjultraktorn i transportarbete. Markgrepp och slirning vid körning med olika typer av slirskydd på olika underlag. [**Wheeled tractors in transport work. Ground adhesion and slip with different types of anti-skid devices on different ground surfaces**.] *Svenska SkogsvFören. Tidskr.* 57 (4), 1959 (529–62). 10 refs. [Sw.e.*e*.]

Describes and illustrates 8 devices (chains, cleats, strakes and tracks) comparing their performance with one of the best tyres of the previous test series [see *F.A.* 20 No. 4674]. Types consisting of a series of flanged plates gave the best ground adhesion, both fixed round the wheel and as half-tracks, on the three surfaces tested (gravel, pasture-land, and forest floor). Other factors affecting choice of device are also discussed.

3234. KLEIBÖMER, H., and HAAREN, A. VON. Betriebskosten eines Schleppersystems. [**Working costs of a tractor system**.] *Forstarchiv* 30 (12), 1959 (229–32). 2 refs. [G.]

An analysis based on the records of Grohnde forest district (Weser region). For a Ferguson E35, with attachments for logging, road maintenance, cultivating, etc. (total cost ca. DM 30,000), used for 2000 hours a year, hourly costs were DM 9–10, of which interest and depreciation amounted to DM 2.70–3.70 (according to the method of depreciation adopted for the attachments) and labour costs DM 3.50. Capital costs were thus a relatively minor item. Even if only 1000 hours had been worked (doubling the charges for capital) costs per hour would have been considerably below contractors' rates. [Cf. *F.A.* 18 No. 821.]

3235. STRØMNES, R. Tohjulstraktorn i skogbruket. [**Two-wheeled tractors in forestry**.] *Norsk Skogbr.* 5 (5), 1960 (157–9). [Nor.]

Describes the satisfactory performance, on packed snow, of the Agria, MotoStandard and Rapid S

Spesial, the first fitted with chains on each wheel, and the other two with half or whole tracks, carried round an extra pair of wheels mounted at the rear of the tractor and a pair of intermediate wheels (a total of 6 wheels).

3236. Keys, G. T. **A comparison with Canadian practice of Russian skidding tractors and their productivity**. *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1968 (*B*–8–*f*), 1960. pp. [3].

Using Soviet data [see *F.A.* 20 No. 4666], compares the specifications and productivity of the TDT-40 (40 h.p.) and TDT-60 (60 h.p.) tractors with those of the Bombardier HDW (115 h.p.). In skidding whole trees, semi-loaded, butts forward, output was: TDT-40, 16·6–20·8 cords/day; TDT-60 29·1–37·4 cords/day; Bombardier HDW, 32 cords/day. The Bombardier's weight is ca. ½ that of the TDT-40 and ca. ⅓ that of the TDT-60.

3237. Belozerov, E. Ja., Gol′dberg, A. M., and Orlov, S. F. Issledovanie processa povala derev′ev na dve opory. **[Investigation of the processes involved in a tree falling on to two supports.]** *Lesn. Prom.* 1960 (2), (19–20). [Russ.russ.]

Experimental timber-harvesting machines are being developed in the U.S.S.R. in which the trees are felled directly on to the machine [cf. *F.A.* 19 No. 4280; 20 No. 1889]; i.e. falling on to one support. In another method, trees are felled on to a tractor-based felling machine fitted with a 2-wheeled trailer, i.e. falling on to two supports—(1) the load-frame on the tractor, (2) a rest on the rear of the trailer. This investigation was to determine the shock (in tons) imparted by the falling tree, and so to provide information for adequate design of the machinery. Support (1) was 2·08 m., and (2) 2·10 m. high; the supports were 12·1 m. apart. In the tests, 34 trees (Aspen, Birch, Pine, Spruce) were felled. Results are shown in tables and a graph. Conclusions are that with trees of mean height 27–29 m. (max. 33), mean volume 1·05–1·88 cu.m. (max. 3·4), mean weight 1·26–1·6 tons (max.3), the mean time taken by the tree to land is 5–5·5 sec. (max. 6·5); the shock lasts on average for 0·016–0·020 sec. (max. 0·027); and the impact load on the trailer's rest is on average 6·4–9·4 tons (max. 14·2). Under these test conditions, the impact load on the trailer was 3–3·4 times that on the load-frame of the tractor. This ratio will fall with decreasing distance between the two points.

3238. Silukov, Ju. D. Dviženie lesovoznogo avtomobilja po snegu. **[The movement of timber lorries on snow.]** *Lesn. Prom.* 1960 (2), (8–9). [Russ.]

Tests were made with a ZIL-157 lorry having 12·00-18 tyres with a special inflation system [cf. *F.A.* 20 No. 3255] in virgin snow (lorry weight, with load, 8350 kg.; snow density 0·33 g./c.c., depth 35 and 50 cm.; air temperature 0° C.), with tyre pressures of 3, 2, 1 and 0·5 kg./sq. cm. Resistance to travel was lowest at a pressure of 1 kg./sq. cm., and the lorry could move freely in snow ⩽ 35 cm. deep. For work in snow ⩾ 50 cm. deep, 14·00-18 tyres should be used.

3239. Kolosov, F. Vyvozka lesa avtomobiljami bez pricepov. **[Extracting timber by lorries without trailers.]** *Lesn. Prom.* 1960 (2), (6–7). [Russ.]

Describes the details of a self-loading device for MAZ-501 lorries (essentially a winch and a heavy-load platform at the rear of the lorry), to make possible extraction of tree-length logs without a trailer. Performances are analysed. The lorries are used instead of heavy tractors for direct extraction for distances from 5 to 17 km.

3240. **Blowout-proof airless tire**. *FAO For. Equipm. Note* No. *B*.20.59, 1959. pp. 1.

The Dayton Rubber Co., Dayton, Ohio, has devised a tyre filled with methane plastic foam, that continues to provide normal support and stability regardless of the amount of damage to the casing or tread. It is not yet on the market.

3241. Suboč, N. I. Lesovoznye dorogi—na teplovoznuju tjagu. **[Timber transport by diesel-electric traction.]** *Lesn. Prom.* 1960 (1), (6–8). [Russ.]

Compares specifications and performance of some Soviet diesel-electric trains with those of conventional steam locomotives, for timber transport on broad- and narrow-gauge railways. The replacement of steam trains by diesels is one of the main tasks in the forest industry in the U.S.S.R. in the current Seven-Year Plan.

3242. **Crane helicopter S-60**. *FAO For. Equipm. Note* No. *B*.21.59, 1959. pp. 2.

A short description of the Sikorsky Crane Helicopter, which can carry loads of 4–6 tons for distances up to 100 miles.

### 378. Water Transport

See also Nos. 3200–1.

3243. Šapiro, A. Mehanizirovannaja podača breven na hobot brevnotaski. **[Mechanized feeding of logs [from the water] on to the log conveyor.]** *Lesn. Prom.* 1959 (12), (22). [Russ.]

Describes and illustrates a system whereby two electrically driven vertical peg-drums rotate in the water near the end of a conveyor. Floating logs are pushed by hand to these drums, which assist them on to the conveyor which brings them ashore.

3244. Roitto, Y. Pölkyn koon vaikutus niputustulokseen ja sen huomioon ottaminen taksassa. **[The effect of the size of log on the bundling result and consideration of this in bundling wage payment.]** *Silva fenn.* 96 (2), 1959. pp. 28. 8 refs. [Fi.*e*.]

Examines a tariff used on the Saimaa water system, based on notes of work performance over several years and taking account of the type of bundling device used. The unit tariff for bundling logs (*a*) differing in size from (*b*) the average, is obtained by dividing the earnings for the bundling of (*b*) by the number of (*a*) logs bundled in a corresponding period. Though size of bundle did not diminish, and an effective incentive was provided, the system failed to level earnings between different bundling devices, or even with one.

3245. ZLOBIN, N. Ploty bez veduščih edinic. **[Rafts without leading units.]** *Lesn. Prom.* 1960 (2), (21–3). [Russ.]

Describes and illustrates a raft design in which all the machinery and braking tackle is carried on the raft bundles themselves, instead of on leading units specially made for this purpose.

3246. Issmelting ved hjelp av trykkluft. **[Melting ice by means of compressed air.]** *Norsk Skogbr.* 6 (2), 1960 (37–8). [Nor.]

Gives data on the use of compressed-air equipment by four timber concerns in different parts of Norway. [Cf. *F.A.* 19 No. 3088.]

### 38. Forest Engineering

See also No. 2708.

### 382. Buildings (Logging Camps etc.)

3247. STACKELBERG, S. VON. Schutzunterkünfte für Waldarbeiter. **[Shelters for forest workers.]** *Forstarchiv* 30 (12), 1959 (232–6). [G.]

Reviews, with illustrations, ready-made equipment for protection in bad weather, including permanent and transportable huts, huts on wheels (one also has runners), builders' huts, roofed benches and tents. Price and specifications of those described are tabulated.

### 383. Roads and Bridges

See also Nos. 2689–90, 2935, 3193, 3201, 3231, 3252, 3611.

3248. Forslag til klassifisering av skogsveier. **[Proposal for the classification of forest roads.]** *Norsk Skogbr.* 5 (5), 1960 (163–4). [Nor.]

Presents a table showing the proposed requirements for speed, gradient, breadth, bearing strength, surface, bridges etc. for three classes of road.

3249. AGER, B. H. **Snow road preparation in Scandinavia.** *Timber of Canada* 21 (2), 1960 (56–8, 63).

An account of Swedish and Finnish techniques and machinery, particularly the power take-off driven roller, the 'snow whip' and the vibrator [see *F.A.* 19 No. 3093], and also the use of snow roads in different phases of transport.

3250. KUONEN, V. Versuch einer Stabilisierung im Waldstrassenbau im Wägital, Kt. Schwyz. **[A trial with stabilization in the building of a forest road in the Wägy valley, Canton Schwyz.]** *Schweiz. Z. Forstw.* 111 (1), 1960 (13–9). [G.f.]

Describes the building of an experimental stretch of road in very difficult soil (flysch region). By constructing a 15-cm. sub-base from gravel and sand mixed with cement, a foundation was formed that made it possible to compact the 20-cm. main layer (base) of gravel and sand and so prevent the fine soil of the subgrade from being squeezed out through the gravel.

3251. KAMIIZAKA, M. **Economic life of bulldozer for forest road construction.** *J. Fac. Agric. Iwate Univ.* 4 (1), 1958 (1–4). 8 refs. [E.] O.R.E.

On the basis of Japanese data, arrives at a figure of 4050–4200 working hours (ca. 4 years)—considerably lower than American and European estimates.

### 384. Protective Works, including Torrent Training

See Nos. 2689–91.

### 385. Drainage, Irrigation, Sedimentation. Water Supply

See also Nos. 3119 *et seq.*, 3201, 3917.

3252. BIRILLO, A. S. Lučšij sposob osušenija zaboločennyh lesov. **[The best method of draining boggy forests.]** *Lesn. Hoz.* 12 (2), 1959 (31). [Russ.]

Considers that the most effective method is to make simple forest roads and then to cut drains on both sides of them. The use of heavy machinery for maintenance and transport is facilitated in this way.

3253. KALNINŠ, A. Tööjõukulu metsakuivendustöödel ning mõningaid nende tööde mehhaniseerimise küsimusi. **[The labour requirement in forest drainage works, and their mechanization.]** In *Metsakuivenduse Küsimusi.* Eesti NSV Teaduste Akadeemia, Tartu. 1959. pp. 135–44. 4 refs. [Est.russ.g.]

More power saws should be made available for clearing the ditch lines, and excavators should be provided for digging the ditches. The need for properly designed trench ploughs for use in forest drainage schemes in the U.S.S.R. is urgent.

## 4. FOREST INJURIES AND PROTECTION

See also Nos. 2820, 3917.

### 41. General Technique of Forest Protection. Types of Injury

See also No. 2624.

3254. INGERSON, H. **Reducing the costs of shade tree spraying.** *Trees Mag., Ohio* 20 (1; 2), 1959 (12–3, 18; 8–9).

Discusses choice of equipment (with reference to location and size of trees), and costing (including depreciation and replacement), for spraying in nurseries, parks, and street plantings.

### 42. Injuries from Inorganic Agencies other than Fire

### 421. Air Currents

See also Nos. 2940, 3486.

3255. PRIOR, K. W. **Wind damage to exotic forests in Canterbury.** *N.Z. J. For.* 8 (1), 1959 (56–68). 3 refs.

The shingle soils of Canterbury, New Zealand, have a consolidated layer at 6–18 in. which impedes drainage and is not penetrated by roots. N.W. gales, especially in winter when the soil is saturated, cause serious damage in the exotic forests situated on these soils. From observations recorded in this paper, it is concluded that the area of forest on such soils ought to be reduced. Until this can be done, the incidence of the damage can be mitigated by planting only the more wind-resistant species (such as *Pseudotsuga taxifolia*, *Pinus nigra* var. *calabrica*, and *P. ponderosa*), by a planting programme designed to produce a normal distribution of age classes, by timely thinning, and by felling in strips oriented across wind and ≯ 5 chains wide. Not enough is yet known about the silvicultural requirements of these forests, and experiments must continue, e.g. on methods of strip felling. *From author's summary*.

### 422. Temperature Influences. Frost. Heat. Drought

See also Nos. 2685, 2835–9, 2880, 2947, 2986, 2995, 3515.

3256. BIRAGHI, A. Fattori climatici termici quali determinanti fenomeni patologici nei vegetali. **[Thermal climatic factors determining pathological phenomena in plants.]** *Repr.* from *Atti della Società Italiana di Patologia, Pavia* 1959 (369–88). 8 refs. [It.]

Discusses, in general terms, but with reference to recent literature, injuries caused to plants by sudden falls of temperature to low levels but not to or below freezing point. Other subjects touched on are mechanical damage due to frost, the effects of rapid thawing, and the physiological, physical and chemical changes accompanying them.

3257. HOLZER, K. Winterliche Schäden an Zirben nahe der alpinen Baumgrenze. **[Winter injuries of *Pinus cembra* near the alpine tree-line.]** *Cbl. ges. Forstw.* 76 (4), 1959 (232–44). 30 refs. [G.]

An investigation of trees in closed stands (1800–2100 m.) and isolated trees up to 2400 m. in the inner Ötztal (Tyrol), based on monthly observations and weather records in 1956–57. No frost injuries were observed [cf. *F.A.* 20 Nos. 236–7]. Needle injuries found on small isolated trees on bare, deeply frozen soil under the influence of dry, warm winds are attributed to lack of moisture. Damaged needles had a m.c. of 103% of dry weight against 135–140% in healthy needles of the same year. Another type of injury, affecting 2-year-old needles, found in branches exposed towards S. or S.S.W., is attributed to radiation, possibly during frequent and rapid alternations of very high and very low temperatures. The injured needles had low osmotic values (18·16 atm., against 26·55 in healthy ones). Their distal halves turned first yellow, then brown, and were later attacked by saprophytic fungi. Excessive light sometimes caused a slight yellowing of needles, resulting in decreased assimilation, but not in the death of cells. Snow pressure and avalanches caused some injuries,but none were observed from blizzards, and no mechanical injuries from gales. Hares did some damage by stripping bark. The effect of needle injuries, whatever their cause, was usually to reduce, but rarely to prevent, shoot growth. This reduced growth of the upper injured parts, combined with vigorous growth of the lower parts that had been prostrated by snow, frequently resulted in peculiar growth forms. It is concluded that for afforestation in the ecotone, to succeed, newly planted trees need protection by artificial barriers that will ensure snow cover for long enough to prevent climatic injuries but not so long as to increase the fungus hazard.

3258. HENKEL, W. Untersuchungen über die Sturmkatastrophe im staatlichen Forstwirtschaftsbetrieb Sonneberg/Thüringen im Jahre 1958. **[The gale disaster in Sonneberg State forest (Thuringia) in 1958.]** *Arch. Forstw.* 9 (1), 1960 (28–46). 12 refs. [G.g.russ.e.]

Describes the damage done by two gales that had thrown or broken > 357,000 cu.m. of wood. Spruce being mostly broken, and Beech mostly thrown. In the worst-hit areas, neither altitude, nor soil type, nor density, health or composition of stands, nor cutting methods or relation to neighbouring stands appeared to have made much difference to the damage. Where the impact was less, mixed stands and certain species, e.g. Douglas Fir, proved less vulnerable than pure Spruce, and silvicultural measures, e.g. mixed stands and windbreaks of storm-hardy trees are suggested to mitigate future disasters.

3259. KONDA, K., and MUTO, K. **[Studies on the frost damage of important plantation species in Hokkaido, Japan. (IV). Frost damage of tree seedlings grown in frozen soil.]** *Res. Bull. Exp. For. Hokkaido Univ.* 20 (2), 1959 (393–403). 39 refs. [Jap.e.*e*.]

Two-year-old *Abies mayriana* seedlings were planted in November in wooden boxes and subjected to different periods of soil freezing and exposure to sun and wind. When the soil was frozen, almost all terminal buds were damaged and 42% of the seedlings died. The moisture content of seedlings in frozen soil and exposed to artificial wind (3·26 m./sec. for 2 hr. daily from 30 Jan. to March) decreased strikingly after exposure to wind, and 50% of them died. Seedlings in frozen soil but shaded from direct sunlight were less damaged—m.c. was higher, 40% of terminal buds survived, and only 29% of seedlings died.

3260. CAYFORD, J. H., *et al.* **Injury to trees from winter drying and frost in Manitoba and Saskatchewan in 1959.** *For. Chron.* 35 (4), 1959 (282–90). 2 refs.

3261. WILNER, J. **Note on an electrolytic procedure for differentiating between frost injury of roots and shoots in woody plants.** *Repr.* from *Canad. J. Pl. Sci.* 39 (4), 1959 (512–3 + 1 plate). 3 refs.

Describes the procedure, which proved useful in differentiating between injury to roots and shoots of Apple seedlings [cf. *F.A.* 16 No. 4174].

3262. RAYMOND, F. L., and HILL, A. W. **Some effects of early fall frost on hardwood vegetation.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 15 (6), 1959 (2–3).

Minimum temperatures of 28°, 22°, and 28° F. on consecutive nights in Sept., followed by a return of mild weather, resulted in browning of leaves of *Acer* *saccharum*, and it is surmised that such early frosts might be responsible for the widespread dieback of twigs of this species.

3263. MESSERI, A. Osservazioni sulla fogliazione del faggio in Calabria. **[The flushing of Beech in Calabria.]** *Nuovo G. bot. ital.* (*n.s.*) 45 (1/2), 1958 (395–7). [It.] A.P.B.

Notes on the effects of a late frost at a time when some individuals were already flushing and others were still dormant. At the end of May the latter were in full leaf while the former were just coming into leaf from the dormant buds that had developed beside the frost-killed buds.

3264. Tørkesommeren 1959. **[The dry summer of 1959.]** *Norsk Skogbr.* 6 (1), 1960 (22–4). [Nor.]

Effects of the drought are briefly summarized; they include: little direct damage to established stands, some reduction in growth, but good growth in the mountain forests; restricted planting operations; increased damage to seed by insects, but good ripening in the mountain forests, and the probability of a good seed-year in 1960; greater damage by fire; reduction of draining operations, but good drying-out of already drained areas; and delays in floating, with increased costs and some increase in damage to timber. Replies to questionnaires on rainfall amounts, effects of the drought on established forests, young plantations and natural regeneration, different effects for different planting methods, etc. give rather more detail for four separate districts of Norway.

3265. SCHEURER, E. Plantagerne i tørkesommeren 1959. **[Plantations in the dry summer of 1959.]** *Hedeselsk. Tidsskr.* 80 (16), 1959 (343–52); 81 (1), 1960 (19–22). 8 refs. [Dan.] C.G.B.

Gives data on the weather, especially the rainfall, in May–Sept. 1959, and discusses its effects. Most of the 1959 plantings survived satisfactorily, except in S. Jutland and Djursland, where mortality was high in new plantations on flat open sites. Damage was heavy in 2- to 5-year plantations, especially on grass-grown sites with little shade or shelter; heavy damage was also caused in Jutland by a night frost on or about 20 June. Douglas Fir proved the most, and Japanese Larch the least, resistant among young plants of conifers grown in Denmark. Among older trees, mortality of Norway Spruce and Scots Pine was above normal in parts of Jutland. The low rainfall figures for May–July suggest that increment of Norway Spruce for 1959 will have been reduced by 0·7 cu.m./ha. [cf. *F.A.* 16 No. 4404]. The drought was responsible for considerable fire damage. A lowered resistance to damage by insects and fungi is expected. Some measures suggested to reduce the effects of droughts include: the provision of more shelter; cleaning between plant rows to reduce competition from grass roots for the available moisture; and covering the soil with brushwood or straw. Greater use of the more drought-resistant species is also recommended.

### 424. Soil Conditions; Erosion Effects

See also Nos. 2685–7, 2843–4, 2881, 3514–7.

3266. **Red Pine chlorosis.** *For. Pest Notes Me. For. Serv.* No. 2, 1959 (10–1).

Application of K (2 oz. commercial KCl per tree) to a chlorotic young plantation of *Pinus resinosa* effected an improvement in colour and length of needles, and length of internodes.

3267. GOSLIN, W. E. **Effects of deficiencies of essential elements on the development and mineral composition of seedlings of Scots Pine (*Pinus sylvestris* L.).** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (6), 1959 (1991). O.R.S.

The effects of deficiencies of N, P, K, Ca, Mg, S, Fe, Mn, B, Zn, Cu and Mo on the growth, foliar symptoms, and mineral-element composition of leaves, stems and roots of seedlings of Latvian (Riga) origin, were studied in greenhouse gravel culture. Deficiency symptoms and growth differences were found in plants deficient in N, P, K, Mg, S, Fe, Ca and B, but no diagnostic foliage characteristics were found for those in cultures lacking Mn, Cu, Zn, or Mo. Omission of an element other than Zn from culture was reflected in a very low concentration of that element in the dry matter of the total plant. Compositions of plants from treatments omitting Zn, Cu, Mn or Mo were more nearly like those of plants supplied with a complete solution. A differential concentration of elements was found in leaves, stem and roots of deficient plants. There was a high Mo concentration in S-deficient plants.

3268. INGESTAD, T. Magnesiumbrist hos gran. **[Mg deficiency in Spruce.]** *Svenska SkogsvFören. Tidskr.* 58 (1), 1960 (69–76 + 2 colour photos). 13 refs. [Sw.e.]

Needles from 3- to 4-year-old seedlings from 3 Swedish nurseries were analysed. Those showing the needle-tip chlorosis characteristic of Mg deficiency (illustrated in colour together with K-deficient seedlings) were found to have Mg values $< 0{\cdot}05\%$ of the dry weight of current year's needles. The symptoms are fairly common in nurseries, and fertilizing with Kalimagnesia ($K_2SO_4 + MgSO_4$) is recommended. [Cf. *F.A.* 21 No. 1541.] *From author's summary.*

### 425. Chemical Influences (Atmospheric)

See also No. 2644.

3269. WENTZEL, K. F. [Editor]. Waldrauchschäden im rheinisch-westfälischen Industriegebiet. **[Smoke damage to forests in the industrial area of the Rhineland and Westphalia.]** Landesanstalt für Bodennutzungsschutz des Landes Nordrhein-Westfalen, Bochum. 1960. pp. 56. [G.]

Report of an international meeting at Bochum in Oct. 1959 discussing the special conditions of the area, diagnosis, effects, and forestry means of dealing with smoke damage, along with summaries of 17 papers (with discussions) including: Forestry in the industrial area with special reference to smoke damage (*K. F. Wentzel*) [stressing also the health aspects of woodlands and tree belts in the region]; Foliar analysis in smoke damage investigations

(*K. Garba*); Symptoms and etiology of injuries by acids and tar (*J. Kisser*); New experiences with turbidity tests (*O. Härtel*) [cf. *F.A.* 16 No. 3779]; The diagnosis of F damage (*W. Merz*); Air analysis as a means of rating danger to vegetation (*H. Stratmann*); Ascertaining the threshold of tolerance [of plants] in open-air trials at Biersdorf/Sieg (*R. Guderian*); Tests on the effect of $SO_2$ under controlled-climate conditions (*H. van Haut*); Seed production of smoke-damaged Spruce (*E. Pelz*); Smoke damage to agriculture and forestry in Czechoslovakia (*B. Mařan*); The effect of dust and soot on the increment of Spruce (*E. Rohmeder*); Dendrochronological investigations near shut-down smoke sources (*K. F. Wentzel*); Silvicultural experiences and measures near an aluminium factory (*J. Kisser*); and Breeding of smoke-resistant Spruce and Pine varieties (*E. Rohmeder*). Many of these papers are scheduled for publication in full in the near future.

3270. PELZ, E. Rauchschadendiagnose. [**Recognizing smoke damage.**] *Arch. Forstw.* 8 (8), 1959 (750–9). 31 refs. [G.g.russ.e.]

A lecture, briefly discussing existing methods of measuring the concentration of toxic substances in the air and biological methods to ascertain smoke damage. It is stressed that, in practice, a combination of several methods will generally be required to prove the damage and its source.

3271. ANDRE, F., and GANGLBERGER, F. Treibstoffabgase—eine Gefahr für den Wald. [**Exhaust fumes, a danger for the forest.**] *Allg. Forstztg.* 71 (1/2), 1959: *Suppl.* (*Informationsdienst* No. 28). pp. 2 [G.]

Considerable concentrations of $SO_2$ in the air were recorded along a mountain road in Austria carrying heavy diesel-lorry traffic, especially on steep gradients and where heavy road-building equipment was in use, but $SO_2$ was also found at a point in the Spruce forest 1 km. distant from the road and 100 m. higher than the road. $SO_2$ concentration in 1- and 5-year-old Spruce needles taken from trees ca. 15 m. high followed a similar pattern to that in the air.

3272. PIRONE, P. P. **The response of shade trees to natural gas.** *Gdn. J. N. Y. Bot. Gdn.* 10 (1), 1960 (25–9). 2 refs.

In order to investigate the allegation that natural gas (n.g.) leaks were reponsible for the death of many shade trees in New York, a series of greenhouse and field experiments were undertaken. Test plants included Pin Oak, London Plane and Norway Maple. It was concluded that n.g. applied to the rooting zone had no toxic effect on the trees, and left no toxic residues in the soil, even when moisture was removed from the gas and even after prolonged treatments (up to 7 weeks), and that the addition of the odorant mercaptan to n.g. likewise had no toxic effect. Trees exposed to manufactured gas, however, soon died. Manufactured gas and n.g. were compared, and it appeared that n.g. does not contain any unsaturated hydrocarbons, HCN, or CO, all of which are present in manufactured gas and are known to be toxic to plants.

### 429. Injuries from Inorganic Agencies (Miscellaneous)

3273. LJUNGGREN, P. Atombombsdetonationerna och den ökade radioaktiva nedsmittningen av skogsträden. [**Atomic bomb explosions and the increased radioactivity of trees.**] *Skogen* 47 (1), 1960 (16). [Sw.]

Measurements in S. Sweden showed for woody plants a large increase of radioactivity (3–10 times that of wood ash or mineral soil) of ash of bark, twigs, and foliage, and rarely any increase in that of the wood. If there are no more explosions, this radio-activity should disappear by 1961. No detailed figures are given.

## 43. Forest Fires

See also Nos. 3887, 3898.

### 431. Predisposing Factors and Causes. Fire Danger. Fire Behaviour

3274. ROUSE, G. D. **Forest fire danger tables for southern England.** *Forestry* 32 (2), 1959 (117–23).

The influence of rainfall, temperature, relative humidity, wind force, and season of the year is discussed shortly in relation to the origin and initial spread of forest fires, and a method of assessing the degree of fire danger is given by reference to five simple tables. *Author's summary.*

3275. MAKSIMOV, S. A. O prirode lesnyh požarov i predskazanii kompleksnogo gidrometeorologičeskogo pokazatelja pogody. [**The nature of forest fires, and fire weather forecasts.**] *Izv. Timirjaz. Sel'.-hoz. Akad., Moskva* No. 6, 1959 (233–8). 4 refs. [Russ.e.] O.W.

Discusses American and Soviet methods of fire danger rating, and spring forest fires in European Russia.

3276. INOUE, K., and MASUDA, H. [**On the control [of] forest fires in Hokkaido (III).**] *Extr.* from *Ann. Rep. For. Exp. Sta., Hokkaido 1958*, 1959 (137–42). 10 refs. [Jap.jap.e.*e.*]

[Cf. *F.A.* 21 No. 597.] Reports on types of air-pressure distribution in Hokkaido in relation to forest fire risk. *From authors' summary.*

3277. COUNTRYMAN, C. M., and SCHROEDER, M. J. **Prescribed burn fireclimate survey 4–57.** *Tech. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 35, 1959. pp. 19.

Limited surface sampling in this September survey in California showed that the wind pattern in a mountain canyon as determined for short time-intervals may be considerably different from that established when observations are made over, say, an hour or more. Because fire responds quickly to changes in wind, fire behaviour may be expected to be more closely associated with the short-period patterns than with the longer-term mean. [Cf. *F.A.* 21 Nos. 1948–9.]

3278. OLSEN, J. M. **Setting up a green fuel moisture study.** *Misc. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 40, 1959. pp. 4.

A short illustrated account of the setting up of a project to study moisture content of green chaparral (San Dimas Experimental Forest, Cal.).

### 432. Prevention and Control

See also No. 3928.

3279. Meyer, A. B. **Missoula: fire headquarters.** *J. For.* 58 (1), 1960 (7–14). 5 refs.

Reviews fire-fighting work and techniques at the H.Q. of the U.S. Forest Service Region One, Missoula, Mont.

3280. Murphy, J. L. **The helijump—the research and development of the helicopter hover jump technique.** *Misc. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 32, 1959. pp. 22. 11 refs.

[Cf. *F.A.* 21 No. 880.] The technique described forms part of Project Helitack, a co-operative research and development programme begun in 1955 between the U.S. Forest Service, U.S. Army, and the California Division of Forestry. Twenty test plots of varied cover type and terrain were used for jumps in which a 175-lb. articulated electronic dummy, clad in a special shock-absorbing, fire-proof suit, was dropped from heights of ca. 10 ft. at speeds of 5–10 m.p.h. Results indicate a further extension of the usefulness of the helicopter as a forest fire-fighting tool.

3281. Murphy, J. L. **California Helitack Report—1958.** *Fire Control Notes* 21 (1), 1960 (1–4).

Reviews the expanding use of helicopters in fire control in California. The newly joined French 'Alouette' did better than the (U.S.) makes in current use.

3282. **Manual release for helitanks.** *Tech. Equipm. Rep. U.S. For. Serv.* No. *F*-6, 1959. pp. 7.

Describes, with drawings and photographs, a manual release for rubberized fabric tanks carried by helicopters.

3283. Mactavish, J. S. **Characteristics of back-pack pumps used in forest fire suppression.** *Tech. Note For. Br. Can.* No. 85, 1960. pp. 23.

Reports the results of tests on 7 different pumps, with tabulated specifications.

3284. Phillips, C. B., and Miller, H. R. **Swelling bentonite clay—a new forest fire retardant.** *Tech. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 37, 1959. pp. 30. 13 refs.

A comparative study of Na Ca borate and swelling-type bentonite clay in 1958 showed that bentonite, commonly used in oil-well drilling mud, is a good forest fire retardant. In 26 trial air-tanker drops on 12 wildfires in California, bentonite appeared to be at least as effective as Na Ca borate. This relative effectiveness was also shown in a series of laboratory tests with bentonite-coated wooden dowels and in field trials on grass and piled brush. All these tests (reported in detail) showed that bentonite was effective as a retardant only for the 2- to 3-hour period that it was able to hold water under summer drying conditions. Considering the cost of the material and its mixing ratio with water, the cost of bentonite is only $\frac{1}{12}$ of that of borate in California. This advantage increases closer to the sources of bentonite and further from the one commercial source of borate. Because the slurry of bentonite requires only ¾ lb./gal. of water (ca. ⅕ the rate of borate), transport and handling costs are relatively low. Bentonite clay is also relatively non-abrasive when used in pumps. It is non-toxic to animals and plants does not compact under prolonged storage, is non-corrosive to metals, and mixes easily into a stable gel, which becomes fluid upon agitation or which can be kept fluid by the addition of certain inexpensive chemicals. When dropped from an air tanker, it shows a drop pattern, canopy penetration, and coating of different fuel types similar to those of borate. To make previous drops visible, a pink aniline dye, which mixed easily with the slurry and added less than one cent. per gallon to its cost, was found to be the best material and the best colour for all conditions. [Cf. *F.A.* 18 No. 4187.]

3285. Inoue, K., and Masuda, H. **[The use of chemicals in brush and grass fire control.]** *Extr.* from *Ann. Rep. For. Exp. Sta., Hokkaido 1958*, 1959 (131–6). 2 refs. [Jap.jap.e.*e.*]

[Cf. *F.A.* 21 No. 608.] A further report on field tests, showing that a chemical fire extinguisher could be satisfactorily used both in direct treatment of the fire and in treating the area ahead of the fire, at a cost of Yen 40–50/sq. m. *From authors' summary.*

3286. Nichols, J. M., and Paulsell, L. K. **A new idea in fire fighting. Air blast line building.** *Bull. Mo. Agric. Exp. Sta.* No. 725, 1959. pp. 8.

Describes, with photographs, two types of blower equipment adapted for use in making fire lines by blowing away litter: (1) a tractor-mounted axial-flow blower; (2) the hand-propelled 'Lo-Blo', fitted to bicycle wheels. With (1) an excellent fire line, 4–8 ft. wide, was made in hardwood litter, travelling in reverse at 1½ m.p.h.; with (2) one man can make a 2-ft. line as fast as 3 men with broom rakes.

3287. Lindahl, R. R., and Kibler, D. B. **Modifications of the U.S.F.S. Model 52 A fire line trencher.** *Tech. Equipm. Rep. U.S. For. Serv.* No. *F*-4, 1959. pp. 6. [Cf. *F.A.* 16 No. 610.]

### 435. Benefits of Fire Control. Injurious Effects of Fire

See also No. 3426.

3288. Storey, T. G., and Merkel, E. P. **Mortality in a Longleaf-Slash Pine stand following a winter wildfire.** *J. For.* 58 (3), 1960 (206–10). 5 refs.

Describes a study of 475 dominant and co-dominant *Pinus palustris* and *P. elliottii* trees in largely even-aged 60-year mixed stands after the Buckland wildfire in Florida, March, 1956. It was found that mortality could be estimated by the amount of crown consumed. About the same number of large and small trees of both species died from equal %s of crown consumption; 87% of trees died when > ½ their needles were consumed by flame, and 42% when < ½ were consumed. Even 100% needle-browning caused no tree death. Presumably this was because initial temperatures of the buds and cambium were low (air temperature was ca. 45° F. at the time of the fire) and were not raised to fatal level by the fire. Height of bark charring on the stem also was related to deaths: 88% died when $\geqslant$ 80% of the stem length was charred, and 39% when 60–80% was charred. There were very few deaths when $<$ 60% was charred. Beetle attack was light. [Cf. *F.A.* 19 No. 4350.]

3289. FERGUSON, E. R., GIBBS, C. B., and THATCHER, R. C. **'Cool' burns and Pine mortality.** *Fire Control Notes* 21 (1), 1960 (27–9). 1 ref.

After a low, creeping 'cool' fire in October on a 10-acre experimental plot of *Pinus taeda* and *P. echinata* in E. Texas, no trees were classified as damaged, but 18 months later many were found to be dead or dying. Though turpentine and ambrosia beetles (*Dendroctonus terebrans* and *Platypus* sp.) were active, the primary cause of mortality was the fire. Scorch marks were rarely $>$ 8–16 in. high on the stem, but prolonged high temperatures at ground level had burnt deep depressions in the bark, killing a total of 110 Pines, or 10% of the merchantable stand. This suggests that assessment for fire damage should include, besides scorched crowns and stems, low basal scorch, particularly after slow ground fires in areas with heavy litter accumulation. [Cf. E. R. Ferguson in *F.A.* 18 No. 551.]

3290. KOCH, G. Incendi estivi e sugherete in Sardegna. **[Summer fires and Cork Oak forest in Sardinia.]** *Monti e Boschi* 11 (1), 1960 (28–32). [It.f.e.]

Describes the damage done to Cork Oaks (one of the most valuable natural resources of the island) and stresses the need for fire control.

### 436. Beneficial Effects of Fire. Uses of Fire in Silviculture and Other Forms of Husbandry

See Nos. 2703, 2706, 2960, 2997, 3277.

## 44. Damage by Harmful Plants. Virus Diseases

### 441. Weeds

See also Nos. 2705, 2953, 3049–55, 3152–6, 3159–60, 3176, 3365.

3291. BERAN, F., and NEURURER, J. Zur Frage der Nomenklatur und Charakteristik chemischer Herbizide. **[Nomenclature and nature of chemical herbicides.]** *Z. PflKrankh.* 66 (8), 1959 (520–34). [G.] E.M.B.

Suggests a 4-figure classifying code for abbreviating information on herbicides. The 4 code numbers give information on: (*a*) the type of herbicide (contact, hormone, soil); (*b*) its potency; (*c*) range of weeds on which effective (monocotyledon, dicotyledon, or both); (*d*) type of weed (annual, perennial). Many examples are tabulated.

3292. MONI, N. S., and GEORGE, M. P. ***Eupatorium odoratum*—a common weed found in the Teak plantations of Kerala State.** *Indian For.* 85 (12), 1959 (728–30).

All methods of controlling this weed have so far proved to be uneconomic. A process has now been developed at Vellayani Agricultural College for extracting the nutrient constituents, giving a yield in lb./acre, of N (200), $P_2O_5$ (100), $K_2O$ (200) and CaO (125). It is proposed to establish a pilot plant to produce fertilizers from *E. odoratum* for field tests. The weed is usually cut twice a year.

3293. WONG, YEW KWAN. **Autecology of the Bertam Palm, *Eugeissona triste*, Griff.** *Malay. Forester* 22 (4), 1959 (301-13 + 4 photos). 7 refs.

An account is given of the autecology of *E. triste*. Attempts to control this weed palm in the past have failed, and an explanation is given of this failure (largely due to the capacity of the rhizome to send up new shoots, and the difficulty of reaching the rhizome itself). The possibility of control by injecting Na arsenite into the soil is discussed.

3294. WYATT-SMITH, J. **The control of Bertam Palm—*Eugeissona triste*, Griff.** *Malay. Forester* 22 (4), 1959 (314–26). 16 refs.

The available information on the numerous trials to control *E. triste* is brought together. This stemless palm forms a material obstacle to the establishment of natural regeneration over areas of forest managed under the Malayan uniform system, particularly along ridges in hill forest. Evidence indicates that either a single moderate (until liquid runs down the rachis) application of 2% butyl ester of 2,4,5-T (10 lb. acid equivalent) in diesel oil sprayed on to uncut clumps to a height of 4 ft., or the cutting of the fronds and the pouring of a 20% aqueous solution of Na arsenite on to the deliberately smashed growing shoot, will kill clumps in a year. Costs depend on the stocking and size of the clumps but should not exceed $40.00/acre in heavily infested areas and should probably amount to half that figure or even less in most areas treated. *From author's summary.*

3295. JONES, R. G. **Observations on the grazing of *Pteridium aquilinum* by sheep in South Wales.** *Pap. 4th Brit. Weed Control Conf.* 1958. pp. 3. 5 refs. From *abstr.* in *Weed Abstr.* 8 (6), 1959 (1092). O.W.

Observations, made during the last 4 years in S. Wales, on the complete or near destruction of bracken by sheep grazing, are described. In these areas colonization by grass was taking place. During 1957–58, further experiments to compare fenced and unfenced areas indicated that weakening and eventual death of the bracken is directly attributable to grazing, although it has not yet been determined whether this is the only cause. A suggested cause is the invasion by some micro-organism, or an alteration in the status of one, affecting the fern in some way. No ill effects have been reported on sheep grazing bracken.

3296. **To beat bracken**. *Farmer & Stockbreeder, London* 73 (3650), 1959 (77). From *abstr.* in *Weed Abstr.* 9 (1), 1960 (171). O.W.

Brief description and illustration of a sprayer mounted above the Holt Weed Breaker. Revolving blades chop the weeds down and the spray, which is fed on to the blades, smears the cut ends of the weeds with herbicides. With certain weeds, this method allows the use of lower concentrations of herbicides, and preliminary trials suggest that this may also be true for bracken.

3297. CONWAY, E. **The bracken problem.** *Outlook on Agriculture, Bracknell* 2 (4), 1959 (158–67). 18 refs. From *abstr.* in *Weed Abstr.* 9 (1), 1960 (129). O.W.

The form, growth, and method of reproduction of bracken are fully described and illustrated, and the effects of mechanical control methods briefly reviewed. In trials in 1957, $NaClO_3$ 170 lb./acre and Na borate (granulated) 300 lb., both applied before emergence, killed all rhizomes in the top 3–4 in. but not the deeper ones. $NH_4$ sulphamate 75 lb./acre, and *p*-chlorobenzoic acid 10 lb., applied before emergence, and $NH_4$ sulphamate 15 lb. and $NaClO_3$ 20 lb. as a foliar spray, were of little or no use. The effects of amitrol and dalapon, at both 20 and 40 lb., on rhizome tips and associated frond buds 8 weeks and one year after treatment and on frond density in the year after treatment are tabulated. The results showed marked reduction in frond density for both compounds, but very little effect on the rhizomes, and it is concluded that neither is capable of eradication. Gibberellic acid tested on first-year plants caused general growth stimulation. The action of phenoxy compounds is discussed briefly.

3298. FRYER, J. D., CHANCELLOR, R. J., and EVANS, S. A. **The effect of [commercial] dalapon upon bracken (*Pteridium aquilinum*)—preliminary field studies.** *Pap. 4th Brit. Weed Control Conf.* 1958. pp. 12. 3 refs. From *abstr.* in *Weed Abstr.* 8 (6), 1959 (1090). O.W.

Part I of this report gives results of experiments to evaluate the effects of date of spraying, volume rate, and method of application; Part II shows up variation in results obtained from several identical trials throughout England and Wales. Both sets of experiments showed very variable results, for reasons as yet unexplained, but it is evident that dalapon up to 20 lb./acre is unlikely to eradicate bracken, though a marked suppression of frond density and vigour can often be obtained. Further experiments, to discover whether application in 2 successive years can eradicate bracken, are now in progress.

3299. CONWAY, E., and FORREST, J. D. **Chemical treatment of bracken in Scotland.** *Pap. 4th Brit. Weed Control Conf.* 1958. pp. 16. 10 refs. From *abstr.* in *Weed Abstr.* 8 (6), 1959 (1091). O.W.

The first part of the paper considers 'a method of measuring the effects of treatment', concluding that the value of any treatment may be judged by (*a*) the number and condition of fronds on unit areas in the years following treatment and (*b*) analysis of samples of secondary branches at periods after treatment. No permanent effect on *Pteridium aquilinum* was given by foliar applications of $NH_4$ sulphamate (150 lb./acre), MCPB (8 lb./acre), amino triazole (40 lb./acre) and/or 2,4,5-T, maleic hydrazide (15 lb./acre), or soil application of $NH_4$ sulphamate (75 lb./acre), TCA (75 lb./acre), amino triazole (20 lb./acre), maleic hydrazide (15 lb./acre) or monuron (60 lb./acre). May applications of Na borate (ca. 2 tons/acre), Na borate + $NaClO_3$ (3/1) (ca. 0·5 tons/acre) gave 100% control (estimated after 18 months) while 2,4,5-D (7·5%) + borates (ca. 0·5 tons/acre) gave 59% control and 4% monuron + borates (ca. 0·5 tons/acre) no control; a mixture of the latter two mixtures was also unsatisfactory. At equal rates dalapon was more effective than amino triazole. One year after application, dalapon (40 lb./acre) was giving 85% control; however, the dormant rhizomes may grow again. Mixtures of dalapon and amino triazole were not particularly effective.

3300. ROZSNYAY, Z. Neue Möglichkeiten bei der chemischen Unkrautbekämpfung im Walde. **[New possibilities in chemical control of forest weeds.]** *Forst- u. Holzw.* 15 (4), 1959 (75–6). 8 refs. [G.]

Summarizes the results of trials in W. Germany in 1958–59 on the use of TCA and/or dalapon for control of grasses and rushes (1) on open areas, (2) in old stands before regeneration, and (3) in Spruce plantations, and also on the use of amino triazole to control *Mercurialis perennis* and *Pteridium aquilinum*, both in stands and on open areas.

3301. REPP, G. Die Anwendung chemischer Unkrautbekämpfungsmittel in der österreichischen Forstwirtschaft. **[The use of herbicides in Austrian forestry.]** *Cbl. ges. Forstw.* 76 (3), 1959 (168–89). 8 refs. [G.g.]

Describes trials in various parts of Austria against (i) *Solidago canadensis* in flood-plain forests, (ii) dwarf shrubs, (iii) bracken, (iv) grasses, (v) brambles, etc. on clear fellings, and (vi) Alder, Hazel, Birch, etc. in conversions of neglected coppice, using (*a*) 2,4-D, (*b*) 2,4,5-T, (*c*) TCA, and (*d*) $NaClO_3$ in various Austrian or German preparations, at various concentrations, dosages, etc. (mostly in water), and discusses duration of effect (4 years of observation), injuries to forest plants and soil organisms, costs, etc. None of the preparations tried had sufficiently lasting effects against (i) and (iii); (*c*) was best, while the (*b*) tests were inconclusive against (i) owing to flooding. Against (iii), Lignopur and Tormona [(*b*) types] gave good control of *Vaccinium myrtillus* at 6 litres/ha. and of *Calluna* at 8–10 litres, without serious injury to young conifer plants. (iv) Only (*c*), (Pantopur 120–150 kg./ha., Nata 200 kg.) was successful; spraying in early autumn, and planting as soon as reasonably safe (3–4 months) are recommended (no trials were made in plantations because of the known high toxicity to forest plants). For (ii) and (iv), (*c*) mixed dry with $CaCO_3$ in a 1/4 ratio gave promising results at low cost. (v) *Rubus* species could generally be controlled satisfactorily with 1% preparations of (*b*), but (*c*) was needed for heavy infestations. (vi) Of various methods tried, best results were obtained—at reasonable cost and without seriously damaging regeneration—by (1) cutting down the heavy coppice and spraying the leafy regrowth with Lignopur F in water or (2) spraying either stumps or the base of the stems (according to whether the coppice had previously been cut or not) with Tormona 100 (3% in oil).

3302. MCCURDY, E. V. **Chemical control of crested wheat grass growing under Ash trees.** *Proc.*

*15th Ann. Nth. Cent. Weed Control Conf.* 1958 (125–6). O.W.

[Cf. *F.A.* 20 No. 4743.] Applications of dalapon at 15 and 20 lb./acre were repeated on new plots in 1958. Excellent control of the grass resulted but at the 15-lb. rate the trees were injured, and at the 20-lb. rate completely defoliated. Amitrol at 4 lb./acre did not affect the grass; at 8 lb./acre the grass was severely retarded and the trees remained normal; at 12 lb./acre the grass was killed but one tree showed slight foliage discoloration in early autumn. Dalapon (14 lb./acre) + Silvex (3½ lb./acre) at 7 gal./acre, applied in late summer, controlled the grass but injured the trees. TCA (40 lb./acre) applied in 1957 on grass growing under Spruce, killed the trees, but dalapon (20 lb./acre) applied in 1958 has so far not even injured them.

3303. PAINE, A. W. **Chemical brush control on public watersheds and supply lines**. *Proc. 13th Ntheast. Weed Control Conf.* 1959 (228–31). From *abstr.* in *Weed Abstr.* 8 (10), 1959 (1887). O.W.

For brush control along inaccessible shores of reservoirs, a mist blower for application of $NH_4$ sulphamate was found extremely useful and effective. The unit weighs about 35 lb., holds 2·5–2·75 gal. of spray, and gives good coverage at 12–15 ft. from the operator with 72 lb./acre of $NH_4$ sulphamate (which is less than half the amount usually considered necessary).

3304. BENNETT, J. M. **Chemical control of conifers**. *Ontario Hydro Research News* 10 (3), 1958 (17–20). From *abstr.* in *Weed Abstr.* 8 (9), 1959 (1701). O.W.

The following results were observed 2 and 3 years after ground applications, during the growing season, to a dense conifer stand, mainly Balsam Fir [*Abies balsamea*] and Black Spruce [*Picea mariana*] with some *Chamaecyparis thyoides* and *Pinus strobus*. Rates are in lb. formulation/100 gal. water except where acid equivalent (a.e.) is specified. Excellent control, TCA at 10–20 (range tried 5–52·5), dalapon at 20–30 (5–25·5); promising, amitrol 52·5 (2·5–52·5), $NH_4$ sulphamate 52·5 (17·4–52·5), 2,4,5-TP 4–10 (3·31–10 a.e.), monuron 4–10 (1–17·4), polychlorinated benzoic acids 4–8 (1–30·2 a.e.); ineffectual, fenuron at 1–5·75, erbon 3·31–19·1 acid ingredient (a.i.), maleic hydrazide 5·75–17·4 a.e., Na chlorate mixture 12·5–62·5, and 2,4-DB 5–10 a.e. The species showed differences in susceptibility, Spruce and Balsam being the most resistant. The effectiveness of TCA was increased by adding 2,4-D + 2,4,5-T mixture at 3 lb./100 gal. and by the use of a wetting agent at 3·5 fluid oz./100 gal. None of these chemicals was effective when applied in the dormant season, except at very high rates.

3305. BENNETT, J. M. **Further developments in the chemical control of conifers**. *Proc. 13th Ntheast. Weed Control Conf.* 1959 (217–27). 1 ref. From *abstr.* in *Weed Abstr.* 8 (10), 1959 (1893). O.W.

When chemicals were applied in the growing season, excellent control of conifers 4–12 ft. high, mainly *Abies balsamea* and *Picea mariana*, was obtained by TCA 8–16 lb./acre, dalapon 15–25 lb./acre and 2,3,6-TBA 5·75–10 lb./acre; 87% control by amitrol 26·25 lb./acre; variable but promising control by monuron 3–8 lb./acre and 2,4,5-TP 4–10 lb./acre; and moderate control by 2,3,5,6-TBA 4 and 5 lb./acre. 2,3,6-TBA and mixed polychlorobenzoic acids were less effective than 2,3,5,6-TBA; fenuron 0·8–4·6 lb./acre. Maleic hydrazide 5·75–17·4 and 2,4-DB 5–10 lb./acre were unsatisfactory. The best control was obtained from spraying in mid-summer after virtual completion of shoot growth. Results from dormant-season applications were greatly inferior.

3306. JAMES, B. L. **Absorption and translocation of maleic hydrazide in *Taxus media* 'Brown' as determined with a radio-isotope**. *Abstr. of thesis*, in *Dissert. Abstr.* 20 (6), 1959 (1944). O.R.S.

Experiments with maleic hydrazide (MH) labelled with $C^{14}$ and applied as an aqueous solution to needles of rooted cuttings showed that: (1) as relative humidity (r.h.) was reduced from 97 to 35%, less MH was absorbed, and the addition of a wetting agent improved absorption at 97% and especially at 57 and 35% r.h.; (2) less MH was absorbed by plants in dry than in moist soil, but the effect of soil dryness was less noticeable at 97% r.h.; (3) MH was translocated basipetally but apparently not acropetally; (4) much of the absorbed MH remained at or near the site of application; and (5) MH appeared to diffuse through dead tissue more readily than it was translocated through living tissue. Amounts absorbed are small compared with those reported for herbaceous plants; the structure and thickness of the cuticle are suggested as being partly responsible.

3307. SMITH, F. L. **Control of roadside vegetation**. *Pap. 4th Brit. Weed Control Conf.* 1958. pp. 5. 2 refs. From *abstr.* in *Weed Abstr.* 8 (6), 1959 (1124). O.W.

Reports the successful and economic use of chemicals for roadside maintenance. Maleic hydrazide at 5 lb./acre + 2,4-D (acid in oil emulsion) at 3·75 lb./acre in 100 gal. water applied very early in spring as soon as grass showed signs of growing has given the best results; encouraging results have also been given by February and December applications. The treatment is only economic if 2 mechanical cuttings are saved. It is particularly useful on embankments and other areas difficult to cut. Woody weeds are dealt with by cutting down, burning and applying a drenching spray of 2,4-D + 2,4,5-T at 3·75 lb. in 60 gal. diesel oil or in 30 gal. diesel oil + 30 gal. sump oil, on and round the cut stumps in the winter. *Fraxinus excelsior*, *Sambucus nigra* and *Crataegus monogyna* may need 2 treatments; *Prunus spinosa*, *Corylus avellana*, *Ulmus procera* and *Acer pseudoplatanus* are easily killed.

3308. DECKER, E. **The use of herbicides in nature sanctuary management**. *Proc. 13th Ntheast. Weed Control Conf.* 1959 (372–6). 4 refs. From *abstr.* in *Weed Abstr.* 8 (10), 1959 (1889). O.W.

In Westmoreland Sanctuary, New York State, 2,4,5-T (amine) was used with success for maintaining paths, dalapon (ester) + 2,4,5-TP (low-volatile ester) for weeds and grass control on paths through fields and openings, 2,4,5-TP (low-volatile ester) for the initial clearance of paths, and erbon for weed control in roadways and parking areas. 2,4,5-T (amine) controlled *Viburnum* sp. *Lindera benzoin, Acer rubrum, Cornus florida, Quercus alba, Q. prinus* and *Parthenocissus* sp.; *Fraxinus americana* was resistant.

3309. MOLBERG, J. M. **Cautions on use of herbicides.** *J. For.* 58 (2), 1960 (124).

Attributes a strange malady of *Acer negundo*, noted in N. Dakota since 1952 and sometimes called 'Boxelder blight', to 2,4-D spraying. Though *A. negundo* may be the only tree with symptoms obvious to the casual observer, a study of increment cores showed drastically reduced increment since 1952 in *Ulmus pumila, Elaeagnus angustifolia*, and *Fraxinus pennsylvanica* var. *lanceolata*. In Wisconsin, all *A. negundo* observed showed symptoms, *Robinia pseudoacacia* was severely affected, and the crowns of *Acer saccharum* and *Pinus strobus* looked unhealthy. The author considers that, unless there is a change in the use of chemicals in N. Dakota, no tree planting made since 1954 will attain predicted height, and no tree planting since 1951 will achieve crown closure. Symptoms of damage, only one of which may be present in a particular tree, are: (*a*) Terminal leaves in upper crown small, chlorotic, malformed,and often bunched, and a dark green margin on leaves of *U. pumila* and *U. americana*; (*b*) many small dead twigs in crown; (*c*) premature death of lower branches, resulting in 'leggy' trees; (*d*) sparse foliage; (*e*) a definite upward sweep of the uppermost lateral branches, giving the appearance of a rounded top. [Cf. *F.A.* 18 No. 4369.]

3310. KIRCH, J. H. **The invert emulsion—a promising new tool for forest management.** *Proc. 12th Ann. Sth. Weed Conf.* 1959 (107–10). 3 refs. O.W.

Discusses the advantages and potentialities of the use in aerial applications of invert emulsions, which, by virtue of their more viscous constituency, are much less prone to drifting than conventional materials. They are applied by a centrifugal spray. Used from a helicopter, for marking purposes, they may also eliminate the use of flagging in Pine release and rangeland work.

3311. DARROW, R. A., and SILKER, T. H. **Hardwood control for Pine release by spraying with helicopter and fixed-wing plane.** *Proc. 12th Ann. Sth. Weed Conf.* 1959 (138–42). O.W.

Aerial spray applications of esters of (*a*) 2,4,5-T and (*b*) 2-(2,4,5-TP) by Stearman plane and helicopter in 1957, indicated that effective top-kill of hardwoods can be obtained by applications of 1½ lb./acre of (*a*) at 8 to 10 gal./acre. A minimum rate of 1½ lb./acre of (*a*) or (*b*) at 4 gal./acre is suggested for helicopter applications, these apparently having some initial advantage in top kill over Stearman applications at 5 gal./acre. Late July treatments with (*a*) and (*b*) were less effective than May treatments on Sweet Gum, Black Gum and Southern Red Oak. Invert emulsions of (*a*) and (*b*) gave greater initial defoliation of Oaks than (*a*) in standard 1/4 oil/water emulsions at two localities in May, 1958, tests. *From authors' summary.*

3312. BRÜNING, D. Wirkung eines Wuchsstoffpräparates zur Abtötung von Robinien- und Roteichenstöcken auf der Düngungsversuchsfläche Scheeren (St FB 'Colbitzer Heide'). **[The effect of a growth-regulator preparation used to kill stumps of *Robinia pseudoacacia* and *Quercus borealis* on [former] fertilizer trial plots at Scheeren ('Colbitzer Heide').]** *Arch. Forstw.* 8 (11), 1959 (964–75). 1 ref. [G.g.russ.e.]

When trees on these plots were felled and the stumps sprayed with 3% Tormona 100 (a 2,4,5-T ester) in diesel oil, the Robinia threw up root suckers only, and most of the Oak stumps were killed. It was noted that the number and height of Robinia suckers, and the survival and sprouting of Oak stumps, were closely related to the former fertilizer treatments; plots that had received K and Mg produced the most vigorous regrowth, and unfertilized controls the least.

3313. SAYRE, R. E., and CHAPPELL, W. E. **Further studies on the use of dormant treatments for brush control.** *Proc. 13th Ntheast. Weed Control Conf.* 1959 (213–6). From *abstr.* in *Weed Abstr.* 8 (10), 1959 (1891). O.W.

A comparison 1 year later of spring, summer, autumn, and winter treatments with 2,4,5-T, with or without 2,4-D, on various brush species including *Quercus* spp., *Robinia* sp., *Rhus* sp., and *Sassafras albidum*, showed no significant difference between seasons of treatment. Results are tabulated and the advantages of dormant-season application listed.

3314. CHAPPELL, W. E., and SAYRE, R. E. **Results of foliar and granular herbicide applications to mixed brush in 1957.** *Proc. 13th Ntheast. Weed Control Conf.* 1959 (240–4). From *abstr.* in *Weed Abstr.* 8 (10), 1959 (1886). O.W.

In trials over 1 year only, amitrol 12 lb./acre applied in June gave excellent kills of *Quercus* spp., *Robinia pseudoacacia* and *Rhus* sp. but was ineffectual against *Sassafras* sp.; 8 lb./acre failed to kill *Nyssa sylvatica*. Trees were 10–12 ft. high. Amitrol was also promising in combination with 2,4,5-T (amine) with or without 2,4-D (amine). The amine salts of 2,4,5-T gave good coppice-shoot control but not such good top kill as the esters. Monuron in granular form and as spray gave good top kill and coppice-shoot control in mixed brush; 5 g./clump (1–10 stems) was as good as 7·5 g./clump; some Oaks and Pines 30–40 ft. away from the treated area were killed.

3315. MCCULLY, W. G. **Fenuron pellet applications for Oak control.** *Proceedings, 7th Annual Texas Agricultural Aviation Conference, College Station* 1958 (G1). From *abstr.* in *Weed Abstr.* 8 (6), 1959 (1052). O.W.

Fenuron pellets at 16 lb./acre will control *Quercus stellata* and *Q. marilandica*. *Ulmus alata* is nearly as susceptible as Oak, and *Ilex vomitoria* is affected. *Crataegus* sp., *Smilax* sp. and *Callicarpa americana* are resistant. The pellets should be applied during active spring growth.

3316. BRINKMAN, K. A. **Killing Oak brush a tricky business.** *Tech. Pap. Cent. St. For. Exp. Sta.* No. 165, 1959. pp. 4.

Various concentrations of 4 herbicides were tested as sprays for killing scrub regeneration of 5 Oak species in the Ozarks (Missouri). In general, *Quercus alba* and *Q. stellata* were easier to kill than *Q. velutina* and *Q. coccinea*. *Q. marilandica* was the most resistant. Spraying in June gave better results than in September. Monuron (cost $190/acre) was effective but uneconomical, while 2,4-D and Ammate were sometimes almost useless. 2,4,5-T (4 lb. acid equivalent/100 gal. and $ 9/acre) was much more efficient in a fuel-oil emulsion than in water,and gave consistently good results in June and August. Because few herbicides kill all trees in one application, the lowest total cost may result from using a spray giving ≥ 70% kill at reasonable cost, with provision for a second application.

3317. DARROW, R. A. **Rangeland and brush control.** *Proceedings, 8th Annual Texas Agricultural Aviation Conference, College Station* 1959 (*H*1–*H*3). 1 ref. From *abstr.* in *Weed Abstr.* 8 (6), 1959 (1059). O.W.

In Oklahoma the general recommendation for the control of Oaks is 2,4,5-T (low-volatile esters) at 2 lb. in 5 gal./acre of a 1/4 oil/water emulsion, applied for 2 years, with grazing deferred to encourage forage improvement. In Texas, successive yearly treatments with 1·25 and 0·75 lb./acre 2,4,5-TP or 1·5 and 1 lb./acre 2,4,5-T (esters) in 4 gal. 1/3 oil/water emulsion is recommended for pure stands of *Quercus stellata* and *Q. marilandica* and a 2-year programme with 2,4,5-T at 2 lb./acre and 1 lb./acre for control of mixed stands including Oaks, *Carya* spp., *Ulmus* spp., and *Liquidambar styraciflua*. Fenuron pellets at 16 lb./acre are recommended for control of *Q. stellata* and *Q. marilandica* on sandy and sandy loam soils and this is said to be equivalent in effect to two treatments totalling 2–2·5 lb./acre with 2,4,5-TP or 2,4,5-T (ester). All recommendations are for aerial treatment.

3318. ELDER, W. C., and WEBSTER, J. E. **Food reserves in Post Oak stumps and roots.** *Tech. Bull. Okla. Agric. Exp. Sta.* No. *T*-80, 1959. pp. 11. 6 refs.

Samples were taken from roots and butts of *Quercus stellata* 10–12 in. in d.b.h.: (1) standing, (2) freshly cut, and (3) freshly cut and treated with 2,4,D + 2,4,5-T in diesel oil, over a period of 20 months. Samples from (3), which showed very little regrowth, had least soluble solids and total sugars, but differences developed only a few months after treatment; (2), which sprouted vigorously, had less soluble solids than (1). No differences in N content and hydrolysable sugars were found between treatments, but roots had about twice as much sugars and 20–30% more N than butts. Food reserves in (1) and (2) were highest from Dec. to Jan. (the usual stump treating time) and lowest in May (just before the usual foliage treating time).

3319. ELWELL, H. M., and WEBSTER, J. E. **Chemical analyses of twigs from Oaks sprayed with 2,4,5-T and silvex.** *Proc. 15th Ann. Nth. Cent. Weed Control Conf.* 1958 (126). O.W.

Twig samples were analysed from small, medium and large Post and Blackjack Oaks 70 days after treatment with 1·8 lb. acid equivalent/acre of (1) 2,4,5-T, and (2) silvex. Data for various sizes and the two species were somewhat inconsistent, but the general trend was as follows: (*a*) a reduction in total sugars of 73% for (1) and 75% for (2); (*b*) a reduced difference for acid hydrolysis of 3% and 6%; (*c*) an increase of total N of 35% and 37%; (*d*) a reduction in 80%-alcohol-soluble solids of 23% and 26%.

3320. HUTNIK, R. J., and BYRNES, W. R. **Late summer spraying of Oak–Maple brush.** *Proc. 13th Ntheast. Weed Control Conf.* 1959 (200–7). 3 refs. From *abstr.* in *Weed Abstr.* 8 (10), 1959 (1894). O.W.

Results 1 year later showed a highly significant increase in the kill of *Quercus* sp. and *Acer rubrum* coppice shoots (mean height 11 ft.) sprayed in late summer with a 1/1 mixture of 2,4-D and 2,4,5-T (butoxy ethanol esters) and with 2,4,5-TP, both at 6 lb./100 gal./acre, when a 1/4 oil-water carrier was used instead of water alone. With the oil/water carrier, 2,4,5-TP was slightly more effective than 2,4-D + 2,4,5-T on Oaks, and slightly less effective on Red Maple. With water as a carrier the results were reversed.

3321. LEONARD, O. A. **Aircraft spraying of Blue Oak.** *California Agriculture, Berkeley* 13 (12), 1959 (3). From *abstr.* in *Weed Abstr.* 9 (1), 1960 (121). O.W.

When 2,4-D, 2,4,-DP, 2,4,5-T and 2,4,5-TP were applied at 2 lb./acre, in May or June, for 1 year only and for 2 and 3 years in succession, the best control of both *Quercus douglasii* and *Q. diversiloba* was obtained with 2,4,5-TP (propylene glycol butyl ether ester) applied for 2 or 3 years. The amine was much less effective. In general, May applications were better than June, and the best time to spray appeared to be as soon as possible after leaf maturity. Phenoxypropionics were superior to phenoxyacetics, and for general brush control 2,4,5-TP was superior to 2,4,-DP.

3322. PETERS, E. J., *et al.* **Control of Persimmon with 2,3,6-TBA and 2,4,5-T.** *Proc. 15th Ann. Nth. Cent. Weed Control Conf.* 1958 (126). O.W.

A dense stand of Persimmon, ranging from ¼ in. to 4 in. in diam. was treated with 2,3,6-TBA and 2,4,5-T, using various rates, formulations, and methods of application. The results are listed. A foliage treatment with 2,3,6-TBA at 4 lb./100 gal. water gave 100% defoliation and no coppicing after 2 years. When applied at 16 lb./100 gal. to the entire soil surface, or in a 2-ft. circle round the base of the trees, 2,3,6-TBA resulted in 100% defoliation with negligible coppicing. Lower concentrations of 2 lb./100 gal. for the foliage treatment and 8 lb./100 gal. for the soil surface treatment proved slightly less effective. Foliage treatments with 2,4,5-T at 2 and 4 lb./100 gal. water were unsatisfactory; 2,3,6-TBA and 2,4,5-T in oil, applied basally were also unsatisfactory.

3323. OWENS, C. B. **Chemical eradication of woody plants.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (6), 1959 (1922–4). O.R.S.

Presents detailed results of trials of Esteron 44 and 245 (the polypropylene glycol butyl ether esters of 2,4-D and 2,4,5-T respectively) and Brush-killer (a 50/50 mixture of the two esters); $NH_4$ sulphamate and the isopropyl ester of 2,4,-D were also used in some tests. The woody species treated were *Crataegus* spp., *Salix* spp. including *S. nigra*, *S. interior*, *S. rigida* and *S. petiolaris*, *Lonicera japonica* and *Ailanthus altissima*. Variables studied included: for *Crataegus* spp., the dosages, concentration, parts treated (root-crown region, basal region of the stem up to 18 in. above the ground, bottom and top halves of the tree canopy, one side of the canopy, stumps), and date; for *A. altissima*, concentration; for *Salix* spp., dosage, parts treated (basal or foliage spray), and whether the bases of the stems were under water at time of application; and for *L. japonica*, concentration (8 lb. acid equivalent per 100 gal. diesel oil slightly damaged Pines in a windbreak in and beside which the *L. japonica* was growing). A graduated plastic sprayer attachment used in measuring the spray material is illustrated.

3324. LITTLE, S. **A progress report on tests of controlling Japanese Honeysuckle.** *Proc. 13th Ntheast. Weed Control Conf.* 1959 (360–6). 4 refs. From *abstr.* in *Weed Abstr.* 8 (10), 1959 (1902). O.W.

Grazing and burning did not effectively control *Lonicera japonica*. The following greatly reduced, but did not eliminate it: 2, 4-D (acid) and a 2/1 mixture of 2,4-D and 2,4,5-T (butoxy-ethanol esters) both at 8 lb. in 125 and 250 gal. water or in kerosene 125 gal./acre; and amitrol 0·125 lb. in 25 and 50 pints water. Spraying was done in June and again in August. The trials indicated that the second treatment was done too soon and should probably wait till 1 year later for 2,4-D and the mixture, and 1 or 2 years later for amitrol. Water as carrier seemed as effective as oil or as oil and water. For 2,4-D, 250 gal./acre appeared more effective than 125 gal., whereas the reverse was true for the mixture. There was no consistent difference between volumes for amitrol.

3325. KREWSON, C. F., and BEHRENS, R. **Preparation of 'double phenoxy' compounds and preliminary evaluation of their herbicidal activity on Mesquite seedlings.** *Journal of Agricultural & Food Chemistry, Easton, Pa.* 7 (8), 1959 (551–3). 4 refs. From *abstr.* in *Weed Abstr.* 8 (10), 1959 (1928). O.W.

The 2-(2,4-dichlorophenoxy)ethanol ester of 4-CPA, 2,4-D, MCPA, 2,4,5-T, 2,4-DP, 2,4,5-TP and 2,4-DB, the 2-(2,4,5-trichlorophenoxy) ethanol ester of 2,4-D, 2,4,5-T and 2,4,5-TP, the 1-(2,4,5-trichlorophenoxy)-2-propanol ester of 2,4-D, 2,4,5-T and 2,4,5-TP and the 2-(2,4,5-trichlorophenoxy)-1-propanol ester of 2,4-D, 2,4,5-T and 2,4,5-TP were prepared by azeotropic dehydration (the method is described and melting points and yields given). Particularly promising results on *Prosopis juliflora* were given by the 2-(2,4-dichlorophenoxy) ethanol ester of 2,4,5-T in greenhouse and field tests, but final evaluation of the experiments has still to be made.

3326. TSCHIRLEY, F. H., and HULL, H. M. **Susceptibility of Velvet Mesquite to an amine and an ester of 2,4,5-T co-related to various biological and meteorological factors.** *Weeds* 7 (4), 1959 (427–35). 21 refs. From *abstr.* in *Weed Abstr.* 9 (1), 1960 (117). O.W.

No quantitative correlation was observed between air temperature and soil temperature at 25 cm. depth, relative humidity, leaf moisture, or nature and content of carbohydrates in the root xylem at time of treatment, and the period of maximum susceptibility of *Prosopis juliflora* var. *velutina* to foliar applications of 2,4,5-T as the triethylamine salt or the propyleneglycolbutylether ester. Defoliation measurements after 12 separate applications of the herbicides between April 29 and July, at 4 lb. acid equivalent/100 gal. in a 1/4 oil/water emulsion, showed the ester to be consistently more effective than the amine salt and to have a longer period of maximum effectiveness. Optimum growth stage for application of the ester occurred when leaves were fully grown but succulent, flowering complete and pod length < 1 in. Mesquite sensitivity to the amine salt decreased after thickening of the leaf cuticle.

3327. MEADORS, C. H., and ROBINSON, E. D. **Aerial application of chemical for the control of Mesquite regrowth.** *Proceedings, 8th Annual Texas Agricultural Aviation Conference, College Station* 1959 (*J*1). From *abstr.* in *Weed Abstr.* 8 (6), 1959 (1073). O.W.

2,4,5-T (low-volatile ester) at 0·5 lb. in a 1/3 gal./acre oil/water emulsion was more effective than 2,4,5-TP (ester) in controlling regrowth of *Prosopis juliflora* 24–60 in. high previously treated by chaining, bulldozing and spraying; it increased root kill by 19% compared with the original treatment.

3328. MEADORS, C. H., and ROBINSON, E. D. **Retreatment of Mesquite regrowth by aerial application.** *Proc. 12th Ann. Sth. Weed Conf.* 1959 (126–8). From *abstr.* in *Weed Abstr.* 8 (7), 1959 (1298). O.W.

2,4,5-T and 2,4,5-TP (low-volatile esters) at 0·25–1 lb. in diesel-oil/water emulsions, were compared with oil-soluble formulations of 2,3,6-TBA for the control of *Prosopis juliflora*. 2,4,5-T gave the most consistent results.

3329. SCHUBERT, O. E. **Comparison of five herbicides used to kill established Poison Ivy in a mature Apple orchard.** *Proc. 13th Ntheast. Weed Control Conf.* 1959 (57–9). From *abstr.* in *Weed Abstr.* 8 (10), 1959 (1885). O.W.

One year after treatments, amitrol at 2 lb./100 gal. had virtually eliminated *Rhus radicans*. $NH_4$ sulphamate at 75 lb./100 gal. also gave excellent control. 2,4,5-T (ester and amine) and 2,4,5-TP, all at 2 quarts/100 gal. gave good average results but showed considerable variance in the plots. 2,4,5-T was better than 2,4,5-TP and the ester better than the amine. The volume was 200 gal./acre for all treatments.

3330. ARLE, H. F. **A summary of results of experiments and field trials relating to Saltcedar**

(***Tamarix pentandra***). In *Symposium on Phreatophytes*. American Geophysical Union, Washington. 1957. pp. 46–52. From *abstr.* in *Weed Abstr.* 8 (9), 1959 (1702). O.W.

The following information has been gained after numerous experiments and trials on the control of *T. pentandra*: it is more difficult to kill on flood-plains than along irrigation channels and streams; single spray treatments are not satisfactory on adult trees and only rarely have 2 repeated treatments given 80% or better control; periodic spraying with 2,4-D and 2,4,5-T will defoliate it, thus reducing transpiration losses; 2,4-D and related materials appear more effective on young regrowth after mechanical destruction than on adult plants; $< 2$ lb./acre has generally given poor results; low-volatile esters of 2,4-D, with or without 2,4,5-T have been consistently more effective than amine or Na salts of 2,4-D; 2,4-D (ester) and 2,4,5-T (ester) applied when the tree is dormant have shown promise; mechanical means, although expensive, are useful where there are dangers of drift; mechanical control must be annual to eliminate coppice and seedlings; Saltcedar is more difficult to kill with 2,4-D and related substances than Willows, Cottonwoods and other woody phreatophytes. Mechanical clearing followed by spraying young regrowth with 2,4-D, with or without 2,4,5-T, at 2·5 lb./acre or more, repeated as necessary once or twice a year, appears to be the most effective and practical method for controlling it.

3331. MOOMAW, J. C. **Progress in chemical Gorse control**. *Technical Progress Report, Hawaii College of Agriculture* No. 119, 1958. pp. 7. 9 refs. From *abstr.* in *Weed Abstr.* 8 (9), 1959 (1708). O.W.

Monuron 85% gave 97% control of *Ulex europaeus* 15 months after treatment, with relatively little effect on other weeds. Monuron and Urox (3(*p*-chlorophenyl)-1, 1-dimethyl-urea trichloroacetate), both at 45 lb./acre, gave 55 and 97% control respectively, and Urox at 25 lb./acre, 86%. In another trial Urox at 100, 200 and 400 lb./acre gave only 45, 70 and 70% cover reduction when applied to a small area (50 sq. ft.), and when applied at 0·125, 0·25 and 0·5 lb. per plant the cover reduction averaged 65, 95 and 85% per plant. These results support the theory that the rate of chemical applied is not a critical factor until the treatment includes the entire soil area in which the plant roots are actively 'feeding'. Germination of Gorse seed taken from plots treated 16 months earlier with monuron at 85 lb./acre was 3·6% compared with 1% for controls, and hard seed was 81·7 compared with 94·1%. TCBA at 45 lb./acre was ineffectual against Gorse.

### 442. Parasitic (Higher) Plants. Epiphytes. Climbers

3332. HAWKSWORTH, F. G. **Distribution of dwarfmistletoes in relation to topography on the Mescalero Apache Reservation, New Mexico**. *J. For.* 57 (12), 1959 (919–22). 10 refs.

The frequency of *Arceuthobium vaginatum* on 2464 Ponderosa Pine plots and of *A. douglasii* on 979 Douglas Fir plots was analysed in relation to topographical position, aspect, steepness of slope, and elevation. Despite the discontinuous occurrence of dwarf mistletoes, correlations between these parasites and topography were found. This suggests that environmental features exert a considerable influence over their distribution. [Cf. *F.A.* 18 No. 569.]

3333. PIERCE, W. R. **Dwarf Mistletoe and its effect upon the growth of Larch and Douglas Fir in Western Montana**. *Abstr. of thesis*, in *Dissert. Abstr.* 20 (7), 1960 (2468). O.R.S.

Describes *Arceuthobium* spp., and discusses their effect on volume (lower growth rate, higher mortality), and quality (poorer form, grain distortion, larger knots), and on size of the viable seed crop. B.a. growth of merchantable Larch and Douglas Fir will be reduced by ca. 14% when $< 33\%$ of the crown is infested, and by as much as 68% when $> 60\%$ is infested.

3334. MIELKE, J. L. **Infection experiments with *Septogloeum gillii*, a fungus parasitic on dwarf-mistletoe**. *J. For.* 57 (12), 1959 (925–6). 4 refs.

The failure of *S. gillii* to establish itself on *Arceuthobium americanum* after experimental inoculation in north Utah and east Idaho, possibly because of the relatively dry climate, suggests that it would have doubtful utility in biological control in this region. [Cf. *F.A.* 15 No. 3705; 17 No. 1723.]

3335. PARMETER, J. R., JR., HOOD, J. R., and SCHARPF, R. F. ***Colletotrichum* blight of dwarf mistletoe**. *Phytopathology* 49 (12), 1959 (812–5). 8 refs.

Describes a disease of *Arceuthobium campylopodum* f. *abietinum* on *Abies magnifica* in the Sierra Nevada, California, killing mistletoe shoots in all stages of development and invading the endophytic system. The spores of the fungus, identified as *Colletotrichum gloeosporioides*, germinated over a wide temperature range, and, in inoculation tests, produced dark lesions circling the shoot in 2 to 3 weeks. These and other characteristics are thought to make it promising as a biological-control agent.

3336. ZIMMER, W. J. **Mistletoes of Victoria**. *For. tech. Pap. For. Comm. Vict.* No. 2, 1959 (21–2).

Lists 12 species occurring in Victoria, indicating the variety of plants susceptible to attack and the preference shown by mistletoes for certain sympathetic hosts, and including *Nothothixis subaureus*, which is generally parasitic on other mistletoes.

3337. HARTIGAN, D. **The Australian mistletoe**. *J. For.* 58 (3), 1960 (211–8). 12 refs.

A review of mistletoe infestation in Australia, with references to the literature.

3338. HARTIGAN, D. **Mistletoe control: a field trial**. *J. Aust. Inst. Agric. Sci.* 24 (4), 1958 (361–2). 3 refs. O.R.E.

Describes a trial on 1000 Eucalypts (of several species) infested with mistletoe (mainly *Amyema miquellii*). Greenham and Brown's injection method [see *F.A.* 20 No. 3322], as published, and also with modifications, was compared with Hartigan's [see *F.A.* 11 No. 1451]. Results are tabulated. It was concluded that the injection method did not warrant adoption as a routine practice on a commercial scale.

3339. GREENHAM, C. G., and BROWN, A. G. **Mistletoe.** *J. Aust. Inst. Agric. Sci.* 25 (1), 1959 (73). 3 refs. O.R.E.

The authors point out differences between their original investigations and those of Hartigan [see preceding abstract], such as different *Eucalyptus* and mistletoe species, variations in method, etc., and defend their conclusions against his.

3340. BROWN, A. G. **Mistletoe control on a large scale.** *J. Aust. Inst. Agric. Sci.* 25 (4), 1959 (282–6). 3 refs. O.R.E.

A complete description of the method already mentioned [see *F.A.* 20 No. 3322].

3341. **Kill mistletoe [*Amyema pendula*].** *Rural Research in C.S.I.R.O., Melbourne* No. 29, 1959 (24–9). 6 refs. I.M.I.

Presents a nomogram and table for computing dosages (by reference to host species, d.b.h., and treatment period) for 8 *Eucalyptus* spp., using the triethanol amine salt of 2,4-D in shallow bore-holes. Further tests are mentioned in which other substances and formulations, particularly the hydrazine salt of 2,4-D, showed promise. Axe cuts, though less effective than bore-holes, were much faster, making the treatment of large areas possible. [Cf. *F.A.* 20 No. 3322.]

3342. BROSSIER, J., and PLAGNAT, F. Nouvelle sylviculture des sapinières à gui. **[New silvicultural measures in Fir stands infested with mistletoe.]** *Rev. for. franç.* 12 (2), 1960 (102–9). 13 refs. [F.]

Mistletoe (*Viscum album* f.sp. *abietis*) in France spreads rapidly, and severely damages *Abies alba* after hot dry periods when the trees are at a relative disadvantage. It attacks old trees, which from 50 to 100 years progressively lose their resistance, and trees grown at altitudes below their natural range. The parasite would be of only secondary importance if felling cycles were adapted to climatic conditions and mean stand age reduced. The use of mixtures is also recommended. [Cf. *F.A.* 12 Nos. 2332–3.]

### 443. Fungi and Bacteria

See also Nos. 2752, 2785, 2934, 2951, 2970, 2990, 2996, 3334–5, 3480, 3922.

3343. HOPKINS, J. C. **A spore trap of the vaseline slide type.** *Repr.* from *Canad. J. Bot.* 37, 1959 (1277–8). (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 572.)

The trap was modified by the attachment of a basal trough draining into a test-tube to recover descending water droplets containing spores. This collected suspension was then added to a suspension prepared from the slide, and a total count of spores made with a haemocytometer.

3344. HIRT, R. R. ***Pinus strobus* L. A literature review and discussion of its fungus diseases in North America.** *Tech. Publ. N.Y. St. Coll. For.* No. 82, 1959. pp. 90. Many refs.

A review of American literature on the fungus diseases of *P. strobus*, dealing *inter alia* with diseases of seedlings, and of plantation and forest trees; mycorrhiza; stain and decay; silvicultural practices to reduce disease; and the status of disease research. Full indexes to the authors cited and to pathogens are included.

3345. **Report, 2nd Session, Working Party on Diseases.** [*Docum.*] *Int. Poplar Comm., 2nd Sess. Wkg. Party on Diseases, Rome 1959* No. *FAO/CIP/MAL*/11, 1959. pp. 6. [E.]

Summarizes statements on diseases made in the reports of National Poplar Commissions, covering *Dothichiza populea, Septoria populiperda, Cytospora chrysosperma, Melampsora* rusts, 'sweating [bleeding] canker' [cf. *F.A.* 20 No. 734], and *Venturia tremulae.*

3346. TARIS, B. Contribution à l'étude des maladies cryptogamiques des rameaux et des jeunes plants de peuplier. **[Fungus diseases of twigs and young plants of Poplar.]** [*Docum.*] *Int. Poplar Comm., 2nd Sess. Wkg. Party on Diseases, Rome 1959* No. *FAO/CIP/MAL*/10, 1959. pp. 13. [F.]

Reports on field and laboratory research on (*a*) *Dothichiza populea*, (*b*) *Cytospora chrysosperma*, and (*c*) *Fusarium avenaceum* [cf. *F.A.* 18 No. 596]. Periods of susceptibility to infection, meteorological conditions, etc., as also behaviour of spores *in vitro* [cf. *F.A.* 18 No. 597] were very similar for (*a*) and (*b*). Both appeared to germinate better in the dark and in weak rather than strong spore concentrations. Spores of (*a*) survived at least 5 years, of (*b*) at least 14 months; for both, *Populus* × *robusta* proved the most, and 'I-214 Casale' the least susceptible clone. Tests with various fungicides and their phytotoxic or stimulating effects are briefly reported [cf. *F.A.* 18 No. 1787; 20 No. 4478; 21 No. 1725]. At all stages, from cuttings to plantation, best results were obtained with Hg preparations, which also stimulated root formation and growth. *F. avenaceum* (*c*) was identified as the pathogen of a disease found on 2- to 3-year-old plants in French nurseries, characterized by a series of longitudinal cracks (compared to scratches of a cat's claw) accompanied by a reddish or purple discoloration frequently found at the boundaries of annual growth. Though the disease is not often lethal, and the cracks heal at a later stage, the trees are unsaleable and the cracks make them susceptible to (*a*) and (*b*). *F. avenaceum*, like (*a*) and (*b*), appears to require a natural or artificial bark lesion for infection; but, unlike them, it can cause infection at any season, if the temperature exceeds 10° C. and the r.h. is 70–80%, though March to July is the period of greatest susceptibility, and May to July that of maximum development of the disease. Susceptibility was greatest with *P.* × *robusta* and *P. deltoides*, and least with *P.* × *serotina* 'de Champagne' and 'I-214 Casale'.

### 443.2. Diseases of Seed and Seedlings; Damping Off etc.

3347. BEJLIN, I. G. *Sclerotinia pseudotuberosa* Rehm. (vredonosnost′, biologija, ėkologija). **[*S. pseudotuberosa*—damage [to acorns], biology,** ecology.] *Soobšč. Inst. Les.* No. 12, 1959 (62–74). 15 refs. [Russ.]

Discusses fungal diseases of acorns in general; the biology and ecology of *S. pseudotuberosa*; rate of spread of the disease in stored acorns; and foci of infection, predisposing factors, and methods of locating foci. [Cf. *F.A.* 21 No. 1983.]

3348. BJÖRKMAN, E. Ny svampsjukdom i skogsträdsplantskolor. **[A new fungus disease in forest nurseries.]** *Skogen* 46 (14), 1959 (292–3). [Sw.]

Serious loss of Pine plants (10 million in one nursery) has recently been caused in Norrland by *Crumenula* (*Scleroderris*) *abietina*, previously known on young Pine and Spruce, but causing little damage. Spraying 2 + 0 Pine with Bordeaux mixture in July had no appreciable effect; research on control continues.

3349. HODGES, C. S., JR. **Studies on black root rot of [Slash and Loblolly] Pine seedlings.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (7), 1960 (2467–8). O.R.S.

Results of studies already reported briefly [see *F.A.* 20 No. 4771] on the nature of the damage, the fungi concerned, and the effect of IAA on cell division in the roots, are given in rather more detail. Soil fumigation with MeBr gave the best control, with Vapam almost as good; Mylone and $C_2H_4Br_2$ were only partially effective and DD was ineffective. Data are given on the reductions in populations of fungi, bacteria, and actinomycetes after the various treatments, and on recolonization.

### 443.3. Diseases of Older Stages

#### Stem, Butt and Root Rots; Root Diseases

See also Nos. 3452, 3516, 3546, 3791.

3350. GIBSON, I. A. S. **Armillaria root rot in Kenya Pine plantations.** *Emp. For. Rev.* 39 (1), 1960 (94–9). 13 refs.

Field studies of *Armillaria mellea* in Kenya Pine plantations in 1953–59 showed that it is most frequent and severe on (*a*) cleared montane rain forest (rainfall 55–90 in./year) and less so on (*b*) cleared montane conifer forest (35–55 in./year). Three localities of (*a*) gave counts of 39, 45, and 47% of trees infected vs. 15, 21, and 22% for (*b*). *A. mellea* was found on every common species. On one (*a*) and one (*b*) site, particularly severe outbreaks were found where Pine had succeeded *Acacia melanoxylon*; the stumps of this species died slowly and were an ideal food base for the spread of *A. mellea*. Eucalypts and Cypress also carried *A. mellea* and gave rise to infection in subsequent Pine plantings. A peak of infection was found in plantations at ca. 5 years, decreasing as resistance of the host increased. *Pinus elliottii* var. *elliottii* was found to be more susceptible to attack than *P. radiata* or *P. patula*.

3351. PURNELL, H. **'Collar-rot' or 'dead-eye' [*Armillaria mellea*] of *Eucalyptus* spp.** *For. tech. Pap. For. Comm. Vict.* No. 2, 1959 (12–5). 5 refs.

Discusses the symptoms, course of infection, and world distribution of *A. mellea*, with particular reference to the situation in Victoria and the causes of the present outbreak (first reported ca. 1954) in which *E. bicostata*, *E. obliqua*, *E. radiata*, *E. rubida*, *E. scabra*, *E. viminalis*, and *Acacia melanoxylon* have been attacked.

3352. BOSE, S. R., and BONET-MAURY, P. **Metabolism of polypores with phosphorus-32.** *Nature, Lond.* 185 (4716), 1960 (828–30). 8 refs.

The object of the studies here reported was to trace the migration of $P^{32}$ from the host plant to the fungus, as well as its migration from the surface of the fruit-body of the fungus to its hymenial layer by direct application on the upper surface of the fruit-body. The techniques used are described in detail. The experiments included growing *Fomes lignosus* on carrot tissue culture that had previously absorbed $P^{32}$; injection of $P^{32}$ into a Lime tree just above and below sporophores of *Ganoderma applanatus* var. *australis*, and application of $P^{32}$ to the upper surface of *G. applanatus* var. *australis* sporophores. Results indicated that the radioactive substance had migrated from the carrot tissue and the tree to the fungi, and from the upper surface of the sporophore to the hymenial surface.

3353. BRAUN, H. J. Zur Frage der Infektion von Schäl- und Schürfwunden durch den Wurzelschwamm *Fomes annosus* (Fr.) Cooke (*Trametes radiciperda* Hartig). **[Does *F. annosus* infect wounds caused through barking by deer or logging?]** *Allg. Forst- u. Jagdztg.* 131 (3), 1960 (67–8). 3 refs. [G.g.e.]

In 203 surface wounds (mostly caused by deer-barking) in a Spruce stand heavily infected with *F. annosus*, no trace of the fungus was found. Its presence in deeper layers in 41 cases was accounted for by infection via the roots. Only 34 of the wounds contained wood-destroying fungi, which appeared to be mainly *Polyporus caesius* and *P. albidus*, the rest, presumably owing to protective resin flow, contained only bacteria and moulds. It is thought that *F. annosus* cannot infect these wounds because the secretions of other micro-organisms [cf. *F.A.* 20 No. 710] inhibit both the germination of spores and mycelial growth.

3354. MOREAU, R., and SCHAEFFER, R. De la maladie du Rond et des moyens de lutter contre elle. **[*Fomes annosus* butt rot and its control.]** *Bull. Soc. For. Franche-Comté* 29 (8), 1959 (436–42). [F.]

In order to confirm Rishbeth's findings on the rsh.
inhibiting effect of *Trichoderma* and *Penicillium* spp. on *Fomes annosus* infection of Pines [cf. *F.A.* 13 No. 1329; 21 No. 632], the authors made a study of the microflora of the soil and rhizosphere in 3 Spruce stands in the department of Doubs: (*a*) free from *F. annosus*, (*b*) slightly infected, and (*c*) severely infected. Results are tabulated and discussed. Among the findings were the small proportion of spore-forming bacteria in (*a*) (3% of all bacteria compared with 12·5 and 12% for (*b*) and (*c*) respectively), and the decrease in number of fungi from (*a*) to (*c*) (0·6, 0·26, and 0·11 millions/g. soil respectively), this being particularly striking in the case of

*Penicillium* and *Trichoderma* spp. These trends were even stronger in the rhizosphere than in the soil. Soil pH was 5–5·2 in (*a*), 5·6–5·8 in (*b*) and 4·8–5 in (*c*).

3355. LECLERCQ, W. L. Dennenmoorder en *Prunus serotina*. [***Fomes annosus* and *P. serotina*.**] *Ned. Bosb. Tijdschr.* 32 (2), 1960 (74–5). [Du.]

Areas in a 12-year stand of Scots Pine, with soil reaction of pH 5, where the Pine had been killed by *F. annosus*, were rapidly colonized by *P. serotina*. When this was cleared for replanting, a number of the trees were found to be carrying fruit bodies of the fungus. The possible danger of using *P. serotina* in mixture with conifers on fairly neutral soils is discussed.

3356. MILLER, O. K. **Red Pine mortality from root rot (*Fomes annosus* (Fries) Cooke).** *Fox For. Note* No. 75, 1959. pp. 1.

Briefly discusses the nature of *F. annosus* attack on *Pinus resinosa* in the light of a survey (summer 1959) made in 58 New Hampshire plantations (detailed results to be published). The hidden nature of the disease, apparent only in its advanced stages, and its tendency to attack crop trees (dominant or co-dominant in nearly every case), may justify frequent salvage cuttings and comparatively costly control measures.

3357. ÖHLMANN, J. Mykologische and Feuchtigkeitsuntersuchungen an einer vom Kiefernbaumschwamm befallenen Kiefer. [**Mycological and moisture investigations on a Pine [stem] attacked by *Fomes pini*.**] *Arch. Forstw.* 8 (3), 1959 (270–84). 11 refs. [G.g.russ.e.]

A 109-year-old Pine, with a small sporophore of *F. pini* at a height of 4·25 m., was felled and examined. The extent of fungus attack followed the normal pattern (i.e. going much further up the stem than down it from the point of attack, and extending only slightly in the radial direction). Wood moisture content within affected heartwood increased with the intensity of attack, and the fungus also seemed to have an indirect influence on sapwood m.c. Wood already attacked by *F. pini* was more susceptible to attack by *Merulius domesticus*, *Poria vaporaria* and *Coniophora cerebella* than healthy heartwood, but less susceptible than healthy sapwood.

3358. LINZON, S. N. **Some associative interactions between *Fomes pini* (Fr.) Karst. and several hyphomycetous fungi isolated from White Pine.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (1), 1960 (3).

Since fungi that do not cause rot are commonly isolated from *Pinus strobus*, it was decided to test the antagonism of selected non-rotting isolates to *Fomes pini*, a fungus responsible for 90% of loss in bd. ft. by decay in living *P. strobus*. Of 7 hyphomycetes tested, by the end of a month one exhibited mutual inhibition with *F. pini*, 4 were inhibited and partly overgrown by *F. pini*, and 2 (different isolates of *Alternaria* spp.) had strongly inhibited and overgrown *F. pini*. Repeated tests showed that these last always inhibited and overgrew *F. pini* in malt-agar plates at room temperature. In other long-term tests to determine the effects of the *Alternaria* isolates on *P. strobus* wood, it was found after 3 years that wood blocks inoculated with *F. pini* were totally decayed, while the *Alternaria* spp., were still confined to the surface of the wood blocks they were growing on.

3359. LOHWAG, K. Holzfäulen an Pappelholz. [**Wood-rotting fungi on Poplar.**] *Istanbul Üniv. Orm. Fak. Derg.* 9*A* (1), 1959 (1–10). 1 ref. [G. Turk.g.turk.]

Discusses damage by *Fomes igniarius* on standing trees, and by *Stereum purpureum*, *Polystictus hirsutus* and *Schizophyllum commune* on logs in a storage depot. Preventive and control measures are also discussed.

3360. DAVIDSON, R. W., HINDS, T. E., and HAWKSWORTH, F. G. **Decay of Aspen in Colorado.** *Sta. Pap. Rocky Mt. For. Range Exp. Sta.* No. 45, 1959. pp. 14. 10 refs.

Examination of 976 Aspen (*Populus tremuloides*) > 4 in. in diam., from 5 national forests, revealed decay in 53% of the trees, accounting for 8·4% of their gross volume. In 50-year stands decay (in cu. ft.) averaged < 2%, in 100-year stands, 4, 8, and 13% for (Baker's) site classes 1, 2, and 3 respectively. Identified fungi (of 17 species) accounted for ca. ⅔ of total decay value. *Cryptochaete polygonia* was the most frequently isolated (28% of identified infections) but *Fomes igniarius* var. *populinus* caused the greatest volume loss (59% of decay associated with identified infections). Most of the butt rot was caused by *Collybia velutipes*, *Fomes aplanatus*, and *Pholiota squarrosa*. *C. velutipes* was associated with the greatest volume of butt decay, and it was also the most frequently isolated butt-rot fungus. *F. applanatus* is important as it is a root parasite and leads to windthrow. *From authors' summary.*

3361. **Cull and volume studies.** *Extr.* from *Rep. For. Br. Sask. 1958/59*, 1959 (8).

A study of *Picea mariana* was undertaken on a co-operative basis, including studies of rot and cull in relation to site, age, and size of trees. Decay is present in many large trees, but does not usually spread beyond the butt, the average % of decayed wood in 1174 trees examined being 1·27.

3362. FERNANDES, C. TAVEIRA. A actividade desenvolvida para a solução de alguns problemas relativos ao castanheiro. [**Work done towards the solution of some problems connected with Chestnut.**] *Publ. Serv. Flor. Aqüic. Portugal* 24 (2), 1957 (221–53 + 8 plates). 31 refs. [Port.f.]

Reviews work achieved in Portugal since 1944, mainly in connexion with the control of 'ink' disease, and the breeding of resistant strains.

### Wilts, Diebacks etc.

See also No. 2775.

3363. BART, G. S. **Susceptibility of various Apple varieties to the Oak wilt fungus.** *Phytopathology* 50 (2), 1960 (177–8). 2 refs.

Eight additional varieties [cf. *F.A.* 18 No. 3017] were successfully infected; discoloration of the xylem and wilting started near the point of inoculation and moved upwards. Two varieties showed discoloured xylem only close to the point of inoculation and appeared highly resistant. The differences in resistance of Apple varieties are thought to make them useful as subjects of research.

3364. BRANDT, W. H. **The effect of Oak wilt fungus upon Oak wood.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (7), 1960 (2510). O.R.S.

Small blocks of White, Red, Scarlet and Black Oak were given a preliminary treatment with the fungus or its metabolic products and then were decayed by fungi found to inhabit wilt-killed trees. Loss of static bending was used as a criterion of the amount of decay. *Endoconidiophora fagacearum* displayed no capacity to decay Oak wood or to weaken it directly, even in conditions permitting associated rot fungi to decrease static bending strength by up to 90%. Rates of decay by rot fungi on blocks exposed to *E. fagacearum* or soaked in a filtrate from liquid cultures or on increment cores from infected trees were not significantly different from those on sound material.

3365. HIMELICK, E. B. **Experimental control studies on the Oak wilt disease.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (5), 1959 (1554–5). O.R.S.

Control measures were tested for 5 years, on a heavily infected forest area of 1648 acres in N. Illinois; the basic method was the provision of barriers to prevent spread through grafted roots, by poisoning healthy trees within root-grafting distances of trees infected in the current year, as soon as possible after initial wilt symptoms appeared. Na arsenite, 2,4,5-T, $NH_4$ sulphamate, and CMU were used to poison both healthy and infected trees. Na arsenite killed trees quickest, checked fungal mat formation, reduced insect attack, and caused some root-kill in treated trees. In the 5-year period, poison barriers were formed round 57 current-year infected trees, diam. $\geqslant$ 4 in., and only 12 trees became infected beyond the barrier zone and within grafting distance of poisoned healthy trees. Where poison barriers were not established round trees killed in previous years, re-treating of some infection centres was necessary to stop further root-graft spread of the disease. Control was obtained in 71% of the infection centres in which barriers were established round current-year infected trees; it was necessary to treat 24% of the centres twice and 5% thrice. Ca. 92% of the current-year infected trees were within 30 ft. of trees previously killed by the fungus. During 4 years of the study, no further spread was observed in 33% of the single-tree infection centres. Only 1% of all centres containing $\leqslant$ 5 trees were active after 5 years. The number of years before the appearance of new infection in individual centres varied from 1 to 6. Six chemicals were tested to determine their effectiveness in killing Oak roots when applied to the soil in a limited zone round a tree. Vapam and MeBr killed all roots up to 3 in. in diam. to a depth of 3 ft.; the other 4 chemicals were ineffective. No chemical injury occurred on adjacent untreated trees. In a study on the elimination of unwanted Oak brush in Pine plantations, 97% of Oak stems inoculated with the Oak wilt fungus were killed within 2 years.

### Cankers, Stem Rusts etc.

See also Nos. 2752, 2763–4, 3345–6, 3929.

3366. ZYCHA, H. Zur Frage der Infektion beim Lärchenkrebs. **[Infection of Larch by *Dasyscypha willkommii*.]** *Phytopath. Z.* 37 (1), 1959 (61–74). 28 refs. [G.g.e.] O.R.S.

Discusses literature on *D. willkommii*, and concludes from observations that the infection follows a pattern different from those hitherto suggested [cf. *F.A.* 20 No. 2014]. Entry is through the scars left by fallen needles, and the short shoots, where needles are most plentiful, are the most likely to be infected. Infection of a shoot is most likely to take place at the end of its second growth season, i.e. after its first needle-fall. Infection may also occur in spring through the buds. The fungus also spreads into the bark until it is stopped by a cell barrier, the position of which depends on the balance between fungal growth and host reaction and is related to weather and to the vigour of the twig attacked. The seriousness of the attack can be estimated from the extent to which it girdles the twig. A canker at the base of a twig will spread in time to the nearest twig below it on the branch.

3367. ARRETINI, C. Esperienze di lotta contro il cancro corticale del castagno in provincia di Avellino. **[Experiments in control of *Endothia parasitica* on Chestnut in the province of Avellino.]** *Monti e Boschi* 10 (12), 1959 (628–33). [It.]

After 10 years of experiment it is concluded that the introduction of *Castanea mollissima* offers no solution to the problem of *E. parasitica* in Italy, since it is unsuited to the climate, inferior in growth to *C. sativa*, and produces inferior fruit. A more hopeful line of development lies in the selection of resistant individuals of *C. sativa* and obtaining planting material from them.

3368. LUTZ, H. J. **Observations on 'Diamond Willow', with particular reference to its occurrence in Alaska.** *Amer. Midl. Nat.* 60 (1), 1958 (176–85). 19 refs. B.A.P.

'Diamond Willow', i.e. trees with diamond-shaped depressions in the stem, was first observed in the middle of the 19th century in the central and upper Missouri valley. The western species most commonly referred to as 'Diamond Willow' is *Salix eriocephala*. Since 1900 or earlier it has been known that 'Diamond Willow' also exists in Alaska. At least 5, or possibly more, species in Alaska may show this characteristic. The known species and varieties are *S. bebbiana*, *S. bebbiana* var. *perrostrata*, *S. pseudomonticola*, *S. arbusculoides*, *S. scouleriana* and *S. alexensis*. They are found from the Kenai Peninsula northward throughout the timbered country of the interior. A fungus or fungi appeared to be instrumental in causing the diamond-shaped markings. *From author's summary.*

3369. MORIONDO, F. La 'ruggine vescicolosa' del pino. **[The 'blister rust' of Pine.]** *Monti e Boschi* 11 (2), 1960 (72–7). [It.f.e.]

Describes the disease (pathogen *Cronartium* *asclepiadeum*) and its occurrence in Italy, where it has been recorded on *Pinus sylvestris*, *P. nigra*, *P. pinaster*, and *P. halepensis*. There is no record of *P. pinea* being attacked even in close proximity to centres of infection.

3370. ANDERSON, N. A. **Stalactiform rust on Jack Pine in Minnesota**. *For. Sci.* 6 (1), 1960 (40–1). 7 refs.

Cankers on *Pinus banksiana* in Minnesota were found to be caused by *Peridermium stalactiforme* (*Cronartium coleosporioides*), which has not previously been reported on Jack Pine east of the Rocky Mountains, except in Canada [cf. R. Pomerleau, *F.A.* 4 p. 190].

3371. **[Fusiform rust, extension of mycelium.]** *Extr.* from *Rep. Sth. For. Exp. Sta. 1958*, 1959 (52–3).

Microscopic examination of many fusiform-rust branch galls at various seasons failed to disclose mycelium more than ½ in. beyond the visible swelling, suggesting that pruning may remove the infection even if quite close to the stem.

3372. JEWELL, F. F. **Inoculation of Slash Pine seedlings with *Cronartium fusiforme*.** *Phytopathology* 50 (1), 1960 (48–51). 2 refs.

Describes, with illustrations, techniques developed for large-scale inoculation. Cotyledonary *Pinus elliottii* seedlings were inoculated by placing telia-bearing Oak foliage over them and maintaining high humidity for 72 hours inside spray tents. Infection was through the needles, with a close correlation between needle spotting and later-developing stem galls. One-year seedlings were successfully inoculated by wrapping the new growth in telia-bearing Oak leaves with high humidity for 72 hours, and also by inserting telia into new stem tissue. Infection was directly into the stem by both methods.

3373. PETERSON, R. S. **Pine gall rust [*Peridermium harknessii*] in the northern Rocky Mountains.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (5), 1959 (1557) O.R.S.

Problems studied in the field and laboratory included the life cycle and seasonal development of the rust, environmental factors causing increase or decrease in populations, including those affecting susceptibility of Pine stands to infection, and kinds of injury (galls and cankers) caused.

3374. MÜLDER, D. *Cronartium ribicola* und *Pinus strobus*. **[*C. ribicola* and *P. strobus*.]** *Allg. Forst- u. Jagdztg.* 131 (2), 1960 (25–33). 19 refs. [G.f.]

A general discussion of the problem in German and American contexts, including selection of seed areas, silvicultural treatment of infected stands, etc., and a plea for field research in Germany into individual differences in susceptibility. [Cf. *F.A.* 19 No. 1973.]

3375. BEGA, R. V. **The effect of environment on germination of sporidia in *Cronartium ribicola*.** *Phytopathology* 50 (1), 1960 (61–9). 15 refs.

Sporidia of *C. ribicola* were subjected to various laboratory tests to determine the effect of environment on germination. Type of germination, i.e. (*a*) direct or (*b*) indirect, vigour, and period involved, were studied, as germination alone was found not to be an accurate measure of sporidial response. No significant effect of light vs. darkness was noted. In (*b*), sporidia were capable of producing up to 6 successive generations, thus prolonging their life and chance of dispersal. Optimum pH in a range from 3·0 to 11·0 was 3·0 for (*a*) vs. 7·0–9·0 for (*b*). Germination was inhibited at pH 2·0 and most vigorous at 4·0; it occurred from 0·5–1° to 24° C. at pH 6·8, and from 0·5–1° to 28° at pH 4·0. The combined influence of time/temperature/pH on (*a*) and (*b*) was studied; (*a*) was favoured at all temperatures studied at pH 4·0. Sporidia germinated on needles of *Pinus lambertiana* from 0·5–1° to 28° C., few secondary sporidia being formed. Significant difference in vigour of germination was noted on needles of 6 species of White Pine tested. *From author's summary.*

### Foliage Diseases

See also Nos. 2787, 3345–6.

3376. MORIONDO, F. Sul disseccamento degli aghi di pino cembro in Alto Adige. **[A needle-blight of *Pinus cembra* in the Alto Adige.]** Accademia Italiana di Scienze Forestali, Florence. 1958. pp. 17. 30 refs. [It.f.]

Attributed to the pathogen *Phacidium pini-cembrae*. [Cf. *F.A.* 19 No. 3176.]

3377. STEFANELLI, A. Le stazione a tasso inadatte per la '*Pseudotsuga Douglasii*' nella Carnia. **[*Taxus baccata* sites unsuited to *P. taxifolia*.]** *Monti e Boschi* 10 (12), 1959 (608–16). 6 refs. [It.f.e.]

A sample plot of Douglas Fir in Carnia (Carnatic Alps) was severely attacked by *Phaeocryptopus gaeumanni*, though the disease had not been observed on other sites in the neighbourhood. The affected plot was found to have a cold moist microclimate with *T. baccata* as its characteristic species. It is suggested that Yew might be regarded as a contra-indication for planting Douglas Fir.

3378. **What's wrong with my trees? Oaks and Laurels in California hard hit by leaf diseases.** *Misc. Pap. Calif. For. Range Exp. Sta.* No. 26, 1958. pp. 2.

Notes on outbreaks of leaf diseases that occurred in California following the exceptionally wet winter and spring of 1958. Species attacking Oak were the leaf-spot fungus *Septoria quercicola* (chiefly on *Quercus kelloggii*), and *Gnomonia veneta*. A leaf-blight of *Umbellularia californica* was caused by at least 3 organisms, including a bacterium (*Pseudomonas* sp.), and 2 fungi (*Kabatiella* sp. and *Gloeosporium* sp.). Other leaf diseases prevalent were rusts (*Melampsora* spp.) on Poplars and Willows, and leaf-blight from the fungus *Marssonia populi* on Aspen.

3379. SNYDER, H. D. **Control of anthracnose of American Sycamore and London Plane.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (6), 1959 (1954). O.R.S.

Symptoms of the disease, and susceptibility of the two species are discussed. Twig cankers, rather than the perfect stage of the fungus, appeared to be the major source of inoculum. In a native Sycamore, 2 to 3 cankers per linear ft. of living branch were found throughout the crown. Pollarding or pruning of diseased parts is reported to give partial to good control. The application of 3 to 5 or more foliar or protective sprays of Dithane Z–78 [zineb type], Manzate [maneb-type], Fermate [ferbam-type], Captan 50W, PMAS [PMA 10%] or Bordeaux mixture proved ineffective. Best control was obtained by a single delayed dormant or bud-break application of PMAS at the rate of 1 pint/100 gal. in hydraulic sprayers or 5 pints/100 gal. in mist blowers. Slight yellowing and/or curling of the first-formed leaves was the only injury caused by PMAS.

3380. HIMELICK, E. B., and NEELY, D. **Hyperparasitism of a powdery mildew fungus on the London Plane Tree.** *Phytopathology* 49 (12), 1959 (831–2). 1 ref.

A fungus, identified as *Microsphaera alni*, frequently infecting the leaves of *Platanus acerifolia* and occasionally those of *Platanus occidentalis* in Illinois, and causing stunting and malformation of leaves and shoots, was found to be parasitized by *Cicinnobolus cesatii*, which is described.

### 444. Virus Diseases

3381. KEGLER, H. Das Ringfleckenmosaik der Eberesche (*Sorbus aucuparia* L.). **[Ringspot mosaic of *S. aucuparia*.]** *Phytopath. Z.* 37 (2), 1959 (214–6). 2 refs. [G.] O.R.S.

The infection, found on plants 1 to at least 10 years old in the Harz, was transferred to healthy plants by bark grafts from infected ones. The symptoms (leaf-spots and other discolorations) are described and attributed to a virus.

3382. CIFERRI, R., CORTE, A., and BIRAGHI, A. Segnalazioni degli 'scopazzi virosici' della robinia in Italia. **[Occurrence of virus-caused witches' brooms on *Robinia pseudoacacia* in Italy.]** *Monti e Boschi* 10 (12), 1959 (595–9). [It.f.e.] [Cf. *F.A.* 20 No. 4816.]

## 45. Damage by Animals

See also No. 2700.

### 451. Mammals

See also Nos. 2703–4, 2962, 2968, 3074, 3175, 3887, 3902, 3922.

3383. HOOVEN, E. F. **Dusky-footed woodrat [*Neotoma fuscipes*] in young Douglas Fir.** *Res. Note Ore. For. Lds. Res. Cent.* No. 41, 1959. pp. 24. 16 refs.

A study was made of *N. fuscipes* in a mixed stand of young *Pseudotsuga taxifolia* and *Quercus garryana* near Corvallis. The effects of previous baiting were noted, the diet of caged wood-rats determined, and population changes on two study plots observed. The main damage noted, viz. severe barking of young Douglas, was to secure nest-building materials, not food. Control by poison bait, or by intensive management to remove cover, appears practicable [cf. *F.A.* 19 No. 1989].

3384. OBRAZCOV, B. V., and ŠTIL'MARK, F. R. Lesohozjajstvennoe značenie myševidnyh gryzunov v dubravah evropejskoj časti SSSR. **[Forestry significance of Muridae in the Oak forests of European Russia.]** *Trud. Inst. Les.* No. 35, 1957 (5–121). 197 refs. [Russ.]

A detailed investigation of the importance of *Apodemus flavicollis*, *Clethrionomys glareolus*, *A. silvaticus*, *A. agrarius* and *Microtus arvalis*, covering population fluctuations, the rodents' influence in natural regeneration and direct sowings, and rodent control. There is a paramount need for the application of wide-spread effective control measures.

3385. LĂZĂRESCU-LAZĂR, A. Vătămări cauzate de pîrşul cenuşiu (*Glis glis* L.) in pădurile de molid de la Cîrlibaba. **[Damage caused by *Glis glis* in the Spruce forests of Cîrlibaba.]** *Rev. Pădurilor* 74 (10), 1959 (620–2). 4 refs. [Rum.]

Investigation of a severely affected stand (pure Spruce ca. 40 years old) showed that 27·5% of all trees had been attacked, the greater number of them in the 8- to 19-cm. diam. classes. The dormice gnaw the bark in spring and, in addition to suffering reduction in increment, the injured tree becomes a prey to barkbeetles. Suggested measures to prevent this damage are to interplant conifers with nut- or fruit-bearing trees or cereal crops, and to encourage the pine marten, which preys upon the dormouse.

3386. SPÎRCHEZ, Z. Pirşul cenuşiu (*Glis glis* L.), duşman al păsărilor insectivore în împrejurimile Clujului. **[The occurrence of *Glis glis*, an enemy of insectivorous birds, in the neighbourhood of Cluj.]** *Rev. Pădurilor* 74 (11), 1959 (670–1). 7 refs. [Rum.]

Describes the biology, feeding habits etc. of this dormouse, which is abundant in Oak and Beech woods in Rumania, and which takes possession of nesting boxes put up to encourage insectivorous birds. [Cf. *F.A.* 18 No. 4269; 19 No. 2014.]

3387. DINESMAN, L. G. Praktičeskie itogi issledovanij pozvonočnyh životnyh v svjazi s polezaščitnym lesorazvedeniem na Džanybekskom stacionare (s 1950 po 1955 g.). **[Practical investigations on the vertebrate fauna in connexion with shelterbelt planting at the Dzhanybek Station (1950–55).]** *Trud. Inst. Les.* No. 38, 1958 (161–70). 4 refs. [Russ.]

Presents tabulated data on the frequency and severity of damage to young plantations by hares, voles and susliks (*Citellus* spp.), and indicates the tree species preferred.

3388. DINESMAN, L. G. Vlijanie meteorologičeskih uslovij na vrednuju dejatel'nost' suslikov. **[Influence of meteorological conditions on the harmful activity of *Citellus* spp.]** *Trud. Inst. Les.* No. 35, 1957 (161–77). 23 refs. [Russ.]

Examination of data for the period 1881–1917 indicates that serious damage by *C. pygmaeus* and *C. suslica* to acorns and young Oaks in S. Russia is most probable six years after periods of intense atmospheric circulation over the Atlantic.

3389. Guay, R. **Water levels—beaver dams.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1891 (*B*-9-*c*), 1959. pp. 1.

Describes and illustrates a method of ensuring a flow of water through a beaver dam by fixing a pipe through the dam with its entry end $\nless 5\frac{1}{2}$ ft. upstream from the dam. The beavers apparently cannot solve the hydraulics of this installation.

3390. Ingles, L. G. **Tree climbing by mountain beavers.** *J. Mammal.* 41 (1), 1960 (120–1). O.R.S.

Late in Oct. 1957, even though only a few inches of snow had fallen, the cache of a colony of *Aplodontia rufa californica* was found to consist entirely of twigs collected from some height on trees of *Abies concolor* and *Pinus contorta.* In June 1959, two ♀s were trapped and caged in a pen enclosing 110 sq. ft. of natural vegetation used as food, and including four trees of *P. contorta.* Within 6 weeks the Pines had been completely pruned of their lateral branches and the terminal buds cut off. Photographs are given of the beavers climbing and carrying twigs.

3391. Kverno, N. B. **The problems in the use of systemic rodenticides.** *Proc. Soc. Amer. For. 1959,* 1960 (97–8). 6 refs.

A short discussion with particular reference to the selective control of the varying hare (*Lepus americanus*) by treating Douglas Fir with tetramine. It is hoped that poisoning of only 5–6 trees/ acre will kill the hares while preserving the black-tailed deer (*Odocoileus hemionus*). Contact repellents applied to foliage (TMTD [thiram]-Rhoplex treatment has given seedlings good first-year protection from hares) are also mentioned.

3392. Cardinell, H. A. **An effective repellent for European hare in Brazil.** *J. Wildlife Mgmt.* 22 (4), 1958 (435–6). 3 refs. B.A.P.

A varnish made of rosin dissolved cold in ethanol effectively repelled *Lepus europaeus* in Rio Grande do Sul, when painted in winter on the stems of young Apple trees.

3393. Besser, J. F., and Welch, J. F. **Chemical repellents for the control of mammal damage to plants.** *Trans. N. Amer. Wildlife Conf.* No. 24, 1959 (166–73). 18 refs. B.A.P.

Reviews work carried out over the past decade at the research laboratories of the Bureau of Sport, Fisheries and Wildlife at Patuxent and Denver in evaluating a large number of chemicals. Three formulations, now commercially available, are highly effective for protection against rabbits and hares, and also useful against deer, meadow mice, beavers and livestock. The active ingredients of these formulations are trinitrobenzeneaniline, ziram cyclohexylamine complex, and thiram. When formulated with certain latex or resin adhesives and suitable additives, they have protected plants for as long as 1 year in some field tests.

3394. Duvall, V. L., and Whitaker, L. B. **Now! a cattle repellent for Pines.** *Forests & People, Alexandria, La.* 9 (4), 1959 (32–3, 46).

Slash Pine seedlings were tied in bundles of 100, dipped in various repellents, and planted out on open range with a heavy concentration of grazing cattle. None of the repellents prevented all browsing, but 6 months after planting out it was found that half the trees treated with $CuCO_3$ had escaped with little or no damage, while 90% of controls were dead or severely browsed. Captan, Arasan, TAT GO and ZAC had some effect but much less. The successful repellent was prepared by mixing 1 gal. Flintkote C-13 HPC asphalt emulsion with 6 gal. water and adding 5·7 lb. $CuCO_3$.

3395. **[Elk and forestry in Russia.]** *Soobšč. Inst. Les.* No. 13, 1959 (58–110). Many refs. [Russ.]

Nine articles: The influence of elk on Pine regeneration in Karelia (*L. P. Nikiforov* and *L. A. Gibet*) [in most cases elk damage was tolerable]; Elk damage to young Pine stands in the Darwin reserve (*M. L. Kaleckaja*) [serious, and worse in stands mixed with, or near, Aspen]; Seasonal features of elk feeding in the Pechora taiga (*E. P. Knorre*) [damage in winter is of no practical importance]; The change in the numbers of elk and reindeer in the Archangel region as influenced by forest fellings (*B. B. Leble*); The influence of elk on forest regeneration in the Bryansk region (*A. V. Fedosov*) [selective shooting to reduce numbers is advised]; Elk in Tartary (*D. I. Aspisov*) [population densities and extent of damage to young stands]; The significance of elk for forestry in the Tatar ASSR (*I. V. Nazarova*) [the planting of *Salix purpurea* as a food source along forest watercourses is recommended, to reduce damage to Pine. Along banks of reservoirs, elk density should be $\ngtr$ 5/1000 ha.]; The influence of elk on Pine and Aspen regeneration in the centre of the European part of the U.S.S.R. (*A. A. Kozlovskij*) [elk density should be reduced to 1/25–30 ha. of young stands]; The part played by elk in forestry (*L. P. Borodin*).

3396. Borodin, L. P. Uveličenie gustoty sosnovyh kul′tur kak biologičeskij sposob zaščity sosny ot losja. **[Increasing the density of Pine plantations as a biological means of protection from elk.]** *Soobšč. Inst. Les.* No. 13, 1959 (124–6). 2 refs. [Russ.]

Investigations in 1951 showed that, in general, the % of trees damaged by elk fell with increasing stand density (from 5200 to 49,600/ha.). Other investigations showed that, under some conditions, damage was virtually the same in dense as in light stands. It is concluded that dense plantations give protection only when elk populations are $\ngtr$ 5/1000 ha.

3397. Dinesman, L. G. Vrednaja dejatel′nost′ kopytnyh v leshozah SSSR. **[Harm done by Ungulata in the leskhozes of the U.S.S.R.]** *Soobšč. Inst. Les.* No. 13, 1959 (5–24). 26 refs. [Russ.]

Gives data on damage caused to forests by *Alces alces, Sus scrofa, Saiga tatarica, Capreolus europaeus, Cervus elaphus* and *Rangifer tarandus* (listed in descending order of importance) since 1953 in various parts of the U.S.S.R., on the basis of replies to a questionnaire.

3398. Sablina, T. B. Adaptivnye osobennosti pitanija nekotoryh vidov kopytnyh i vozdejstvie ėtih vidov na smenu rastitel′nosti. **[Adaptation in**

**the feeding of some Ungulata, and the effect of these species on the succession of vegetation.]** *Soobšč. Inst. Les.* No. 13, 1959 (32–43). 25 refs. [Russ.]

Discusses, *inter alia*, the parts of advance growth (with their dimensions) preferred by 5 common wild Ungulata in the U.S.S.R., and, in consequence, their tolerable population densities. No conclusions are reached.

3399. ALMĚŠAN, H. A. Lesnoe hozjajstvo i dikie kopytnye v Rumynskoj Narodnoj Respublike. **[Forestry and wild Ungulata in the Rumanian People's Republic.]** *Soobšč. Inst. Les.* No. 13, 1959 (118–23). 2 refs. [Russ.]

A general account, covering tolerable densities, selective shooting to reduce and improve populations, etc.

3400. EYGENRAAM, J. A. Over het beheer van de edelhertenbevolking in Nederland. **[The management of red deer in the Netherlands.]** *Ned. Bosb. Tijdschr.* 32 (1), 1960 (1–20). 19 refs. [Du.du.g.e.]

The red-deer population is confined to the Veluwe and comprises ca. 1500 deer in parks and fenced reserves, and ≯ 600 in forests and heaths (30,000 ha.) outside these enclosures. Stomach analyses on 308 deer, the majority shot in September–March, showed that the greater part of the food, both in frequency and in volume, consisted of *Calluna vulgaris*, grasses, and green Pine needles. The consumption of grasses decreased and that of Pine needles increased as the winter progressed. Most serious damage to trees was by bark stripping, usually between the 4th and 5th whorls of 7- to 8-year-old trees. In recent years most fields in the area have been fenced, and damage in forests has increased. Recommendations include: providing feeding grounds and supplying food (e.g. hay, potatoes) during winter; mixed plantings including *Sorbus* spp., Birch, Willow, Hawthorn, etc.; protection of susceptible plantations by chemical and mechanical means; and regulation of population density to 3 deer/200 ha. [cf. *F.A.* 21 No. 2027].

3401. SCHULZ, H.-E. Rotwild und Forstschutz. **[Red deer and forest protection.]** *Arch. Forstw.* 9 (1), 1960 (1–18). 31 refs. [G.g.russ.e.]

A discussion of the problem with special reference to E. Germany, based on German and E. European literature. While theories of nutrient deficiencies to explain barking have not been borne out by bark analyses or field trials with special licks etc., recent research suggests that the physiological needs for tough, hard and even indigestible material, and the behavioural urge to extensive foraging, are not met by the methods of winter feeding commonly used. Where horse-chestnuts were scattered over a wide area, barking ceased; when they were offered at one place it was resumed. Chain-feeding, i.e. the provision of different foodstuffs in small amounts at different places, is suggested to keep the deer on the move. Other contributory causes of barking discussed include the need for water (young bark had a m.c. of 40–65%), sheer habit (e.g. acquired, even where not physiologically necessary, from continual repetition), disturbance of habitats (e.g. a fence cutting across a track), sex and age structure of the population (♀s bark more than ♂s and young ♂s more than old ones), internal parasites, etc. Even in the most suitable areas, a density of 2–3 deer/100 ha. is considered the maximum, and in areas where pure conifers predominate this is often too high.

3402. GRAHAM, S. A. **Results of deer exclosure experiments in the Ottawa National Forest.** *Trans. N. Amer. Wildlife Conf.* No. 23, 1958 (478–90). B.A.P.

Exclosures were established in (1) a mixed conifer/hardwood 'seepage swamp', (2) a mixed northern hardwood/Hemlock stand, and (3) White Pine forest. The stands were felled before fencing. In (1) felling operations [unspecified] began in 1947–48 and were completed in 1949; 1 or 2 seasons elapsed before fencing, varying in different plots. (2) was felled in 1946–47 and 2 seasons elapsed before fencing. In (3) the time elapsing after felling and before fencing varied between 2 and 7 years. Selective fellings to favour White Pine were begun in (3) in 1941–42 and completed in 1953. Records of species composition within and outside all the exclosures, taken in 1957, showed that the effects of browsing vary widely in different forest types and therefore ought always to be evaluated on a local basis. In general, White Spruce is very little browsed by deer. Yellow Birch, Basswood, Hemlock, White Cedar and Aspen are eagerly sought and have been greatly reduced or eliminated outside the exclosures, whereas, inside, regeneration of these species was abundant wherever conditions favoured it. Other species such as Hard Maple and Red Maple are browsed, but will often recover and grow out of reach of the deer. Severe browsing on Balsam Fir or Black Spruce sometimes occurs, but usually indicates an excessively high deer population or a local concentration of browsing. Regeneration of Pine in the exclosures was less abundant than expected, possibly owing to the destruction of small seedlings after felling and before fencing. In (3) deer browsing has favoured conifers (particularly Balsam Fir and White Spruce), White Birch and Aspen being almost eliminated. In (1) Balsam Fir stocking is higher outside than inside the exclosures. Here the probable composition of the future forest outside the exclosures will be Balsam Fir, Maples and White Spruce. In (2) the effects of browsing have been disastrous. Hard Maple and, to a lesser degree, Red Maple are the only species that have been able to survive the effects of browsing and will probably form the major component of the future forest; Yellow Birch will be reduced to < 5%, Elm to < 2%; Basswood and Hemlock were completely eliminated by 1957.

3403. MCNEEL, W., JR., and KENNEDY, J. **Prevention of browsing by deer in a Pine plantation.** *J. Wildlife Mgmt.* 23 (4), 1959 (450–1). B.A.P.

Severe autumn and winter damage to a young White, Red, and Jack Pine plantation in Michigan was successfully prevented by stapling 3 × 4-in. strips of light-weight plastic around the terminal and some lateral buds. Two men working together were able to cover the terminal buds of 150–200 trees/hour where trees were ca. 8 ft. apart. Twelve trees could be covered by 1 sq. ft. of plastic costing ca. 2½ cents. The covering did no harm to the buds, but it should be removed as soon as growth begins in the spring.

3404. DAWKINS, H. C. **Further experience of electric fencing.** *Tech. Note For. Dep. Uganda* No. 80, 1959. pp. 5.

A fuller account of experiments already reported elsewhere [cf. *F.A.* 21 No. 2036].

### 452. Birds

See also No. 2702.

3405. GODSAL, P. H. **Operation starling, 1960.** *J. Land Agents' Soc.* 59 (4), 1960 (146–9).

Describes successful operations (combined bonfires and gunfire) to get rid of a plague of roosting starlings in an acre or so of conifers with rhododendron undergrowth, on the banks of Terrybank Tarn. Operations were concentrated on two nights, starting early enough to prevent the birds from roosting.

### 453. Insects

See also Nos. 2752, 2934, 2951, 3133, 3891, 3900.

3406. TORRENT, J. A. Resumen de los trabajos realizados por la Sección de Tratamientos durante las campañas 1958–9 y anteriores. **[Summary of the work of the Control Section during the campaigns of 1958–59 and previously.]** *Bol. Serv. Plagas For., Madrid* 2 (4), 1959 (135–9 + 2 tbls.). [Span.]

Presents data on control work of all types carried out since 1953, with special reference to the work of 1958 and 1959.

3407. TORRENT, J. A. **Aviation in Spain and its part in the control of pests in forestry.** *Agric. Aviation, The Hague* 2 (1), 1960 (14–21, 33–5). 6 refs. [E.g.f.] O.R.E.

A general review of experience, mainly on *Quercus* spp. and *Pinus* spp. The planning of the operations, types of aircraft and chemicals used, areas treated, and costs are discussed.

3408. DAFAUCE, C. Plagas de insectos en los viveros forestales. **[Insect pests in forest nurseries.]** *Bol. Serv. Plagas For., Madrid* 2 (4), 1959 (75–105). 28 refs. [Span.]

Short notes on the biology and control of a large number of pests, including Scarabaeidae, Elateridae, Cerambycidae, Curculionidae, Tipulidae, Noctuidae, Gryllidae, aphids and ants under Spanish conditions.

3409. NOGUEIRA, C. D. SERRÃO. Alguns insectos da biocenose dos chopos em Portugal. **[Some insects of the Poplar biocoenosis in Portugal.]** *Publ. Serv. Flor. Aqüic. Portugal* 24 (1), 1957 (41–177 + 7 plates). 99 refs. [Port.port.e.]

The study consists of 4 parts: (1) General notes on Poplar, its botanical characters, systematics, evolution and importance, with special reference to Portugal, (2) a list of 49 insects associated with Poplar in Portugal, with notes on their morphology, biology and distribution, (3) a list of the same insects classified according to the parts of the tree they inhabit, and (4) a taxonomic list of all insects known to attack Poplar, distinguishing those known to occur in Portugal.

3410. RICHTER, D. Über Insektenschäden in Korbweidenhegern und ihre Beurteilung. **[Insect damage to Osier beds and its assessment.]** *Arch. Forstw.* 8 (12), 1959 (1057–77). 4 refs. [G.g.russ.e.]

A description and statistical analysis of the (often considerable) damage caused to both quantity and quality of Osiers by (1) *Cryptorrhynchus lapathi* [cf. *F.A.* 19 No. 2065], (2) *Earias chlorana* [cf. *F.A.* 20 No. 791], (3) *Rhabdophaga terminalis* [cf. *F.A.* 15 No. 517], (4) *Schizotetranychus schizopus*, (5) *Smerinthus ocellata* and *Dicranura vinula* [cf. *F.A.* 19 No. 3218], and (6) *Aphidula farinosa*, based on observations and experiments at Graupa research station, Saxony. The problem is highly complex, owing to a multiplicity of factors, such as the effect of stool vigour on susceptibility and power of regeneration, seasonal differences in reaction to attack, preferences of insects for varieties or species, or for the larger or the smaller shoots, after-effects e.g. of larval injury to stools by (1) or late-season defoliations by (5), etc.

3411. SLEPJAN, È. I. Strukturnye osobennosti razvitija parazitarnyh novoobrazovanij na vegetativnyh organah Salicaceae. **[Structural features in the development of parasitic neoplasms on vegetative organs of Salicaceae.]** *Dokl. Akad. Nauk SSSR* 129 (6), 1959 (1434–7). 1 ref. [Russ.] A.P.B.

An account of the structure of neoplasms (mainly galls) on the leaf blade (four main types of neoplasm), midrib, petiole, and stem, indicating the families of insects responsible and discussing the structural specialization of galls.

3412. MIKLOŠ, I. Zapažanja o pojavi i štetnosti nekih insekata na crniki u Hrvatskom Primorju i Dalmaciji. **[The occurrence of and damage by some insects on *Quercus ilex* on the Croatian coast and in Dalmatia.]** *Šum. List* 83 (6/7), 1959 (195–203). [Croat.it.]

Deals especially with *Phylloxera quercus*, *Sinoxylon sexdentatum*, and *Tortrix viridana*. The other 11 species discussed are of minor importance. *From author's summary.*

3413. SCHREMMER, F. Beobachtungen und Untersuchungen über die Insektenfauna der Lärche (*Larix decidua*) im östlichen Randgebiet ihrer natürlichen Verbreitung, mit besonderer Berücksichtigung einer Grosstadtlärche. **[The insect fauna of *L. decidua* on the eastern border of its natural range, with special reference to a tree in a big city [Vienna].]** *Z. angew. Ent.* 45 (1), 1959 (1–48); 45 (2), 1960 (113–53). 62 refs. [G.g.e.] O.H.

Describes the arthropod fauna (including spiders and mites) of one isolated Larch 15 m. high, in the courtyard of Vienna University about 25 km. E. of the nearest natural stands and, for comparison and supplementation, observations at 3 woodland sites, two near Vienna, one in Styria. A table of species found in each locality, classified into phytophagous insects, parasites, predators, etc., shows that only a few species appeared to be restricted to the forest, and that the isolated tree was colonized by many monophagous Larch insects and their enemies, e.g. *Coleophora laricella*, *Tmetocera lariciana*, *Dasyneura laricis*, *Adelges laricis*, *Sacchiphantes* [*Adelges*] *viridis*, and *Cinara laricis*. The development, bionomics etc. of these and others are discussed, including the predator complex of the Adelgidae and Cinarines, the development of the Larch bark tortrix *Laspeyresia* [*Enarmonia*] *grunertiana*, the coniopterygid *Conwrentzia pineticola*, the gall mite *Eriophyes pini* var. *laricis* (distinguishing their galls from those of *D. laricis*), new local finds of *Cryphalus intermedius*, and *Taeniothrips laricivorus* in the Western Vienna woods, etc.

3414. WONG, H. R., DROUIN, J. A., and MCLEOD, B. B. **Observations on a 'complex' of insects in tops of Black Spruce in Manitoba and Saskatchewan.** *Repr.* from *Canad. Ent.* 91 (9), 1959 (543–8). 6 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 544.)

A 'complex' of insects collected from defoliated crowns of *Picea mariana* was found to consist of the following species: *Recurvaria* sp., *Herculia thymetusalis*, *Archippus alberta*, *Dioryctria abietivorella*, *Epizeuxis americalis*. The insects were found most abundantly in 'club-top' crowns, though there is no evidence that they cause this condition. The 'complex' appears to prefer dense foliage, cones, and branches. A field guide to the species is presented. [Cf. *F.A.* 21 No. 3461.]

3415. ÇANAKÇIOĞLU, H. Orman ağaçlarımızın tohumlarına ârız olan böcekler ve bazı önemli türlerin mücadeleri üzerine araştırmalar. **[Studies on insects injurious to forest tree seeds, and control of some of the important species.]** *Istanbul Üniv. Orm. Fak. Derg.* 9*A* (1), 1959 (126–67). 31 refs. [Turk.*e.e.*]

Discusses the 2 species of Acarina, 12 species of Coleoptera, 16 Lepidoptera, 5 Hymenoptera and 2 Diptera so far found damaging seed of forest tree species in Turkey, and indicates for each the tree species damaged and the nature of the damage. In all, 17 conifer and 14 broadleaved species are involved. Fuller data, including life history and control, are given for the more important insects, especially *Balaninus elephas* and *Laspeyresia splendana* var. *reaumurana*, both of which do much damage to Oak and Chestnut.

3416. STEVENS, R. E. **Surveys of Douglas Fir cone and seed insect damage in Northwestern California, 1954–1958.** *J. For.* 57 (12), 1959 (897–9). 7 refs.

Describes the destructive effect of *Barbara colfaxiana*, *Dioryctria abietella*, *Megastigmus spermotrophus*, and a gall midge (probably *Contarinia oregonensis*), and tabulates the results of annual surveys made to assess chalcid and moth damage [cf. *F.A.* 18 No. 3063].

## Insects: Natural and Biological Control

See also Nos. 2702, 3430–5, 3438–41, 3449–50, 3451, 3454–6, 3464, 3466, 3468–9, 3472, 3481–2, 3498–3501, 3503–4, 3508–11.

3417. **[Papers presented at a colloquium on insect pathology, La Minière, October 1958.]** *Entomophaga, Paris* 4 (3), 1959 (193–274). Many refs. [F.E.or G., e.g. or f.] O.H.

Includes 3 papers on *Bacillus thuringiensis*: The susceptibility of Lepidoptera to the 'Andure' strain (*A. Burgerjon* and *P. Grison*) [suggesting that *Thaumetopoea processionea* and *Malacosoma neustria* are highly susceptible, *T. pityocampa*, *Tortrix viridana* and *Operophtera brumata* less so, and *Lymantria dispar* and *Euproctis phaeorrhoea* only moderately so]; Applications of this strain (*D. Martouret*) [including trials of dosage and treatment time for *Thaumetopoea pityocampa* and *Tortrix viridana*]; The effect of E-58 powder on *Malacosoma neustria* (*E. N. G. van Damme* and *P. A. van der Laan*) [this powder, containing the crystals produced by the bacillus, was very promising against young and old larvae]. Other papers are on: The organism causing milky disease in *Melolontha melolontha* larvae: (*a*) Heat resistance (*A. Bonnefoi* and *M. Toucas*); (*b*) the most virulent strains (*B. Hurpin*); Production of the inclusion bodies of the *Thaumetopoea pityocampa* virus (*D. Martouret* and *G. Dussaussoy*); and Breeding Entomophthoraceae (*E. Müller-Kögler*).

3418. CEBALLOS JIMÉNEZ, P. Brachymerinae que pueden tener interés forestal. **[Brachymerinae of possible forestry interest.]** *Bol. Serv. Plagas For., Madrid* 2 (4), 1959 (129–33). [Span.]

Describes briefly 6 species of *Brachymeria*, parasites of forest pests in Spain.

3419 SZMIDT, A. Die Wirtswahl von *Dahlbominus fuscipennis* (Zett.) (Hym. Chalcididae) und die Eignung des Wirtes für die Parasiten. **[Choice of host by *D. fuscipennis*, and the suitability of the host for the parasites.]** *Anz. Schädlingsk.* 33 (2), 1960 (20–2). 4 refs. [G.g.]

When females of *D. fuscipennis* reared from *Gilpinia frutetorum* were offered larvae of *G. frutetorum* in artificial cocoons made (*a*) of two normal ones, (*b*) of the web of *Galleria mellonella* and (*c*) of plastic, nylon tissue, or wire mesh, only (*a*) and (*b*) were accepted, with some preference for (*a*), suggesting that the important stimulus was cocoon structure. The presence in (*a*) of dead larvae of the parasite did not prevent acceptance, suggesting that the avoidance of already parasitized cocoons in nature is due not to smell but to a mechanical stimulus. When larvae of both host species were offered in *Gilpinia* cocoons, both were attacked to about the same degree, but actual oviposition was somewhat less on *Galleria* larvae, and only 3 out of 40 eggs on these developed to (sterile) imagos. When eggs and larvae of the parasite were transferred from one *Gilpinia* larva to another paralysed one, they developed normally, but if transferred to a healthy larva they were killed by its defensive movements.

3420. OTTO, D. Der Einfluss von Waldameisenkolonien auf Eichenschadinsekten in einem Forstrevier des nördlichen Harzrandes. **[The effect of colonies of *Formica rufa* on Oak pests in a forest district of the northern foothills of the Harz mountains.]** *Waldhygiene* 3 (3/4), 1959 (65–93). 14 refs. [G.g.]

Observations on ant activity, pests destroyed (chiefly *Tortrix viridana* and *Cacoecia* spp.), etc., extending over 3 years, largely confirmed preliminary findings [cf. *F.A.* 19 No. 4458] on reduction of defoliation in small plots having many nests. Egg densities were also considerably reduced, but pupal densities per shoot were higher than on the antless plots where more or less complete defoliation caused the larvae to leave the bare trees and pupate in the ground or on the bark. The effect was also somewhat masked by cockchafer invasion, by the cold summer of 1958 which restricted ant activity more than larval feeding, and by the fact that, even in the ant plots, the tops of trees were severely defoliated by the small early instars, and by reinfestation. In favourable conditions, up to 7000 larvae and 280 pupae or imagos per hour were counted per nest. Radius of activity was 15–25 m., and it is estimated that 4–7 nests/ha., evenly spaced, could prevent complete defoliation.

3421. LANGE, R. Zur Trennung von *Formica rufa* L. und *Formica polyctena* Först. (Hym., Formicidae). Der artspezifische Duft. **[The distinction between *F. rufa* and *F. polyctena*. The scent peculiar to each species.]** *Z. angew. Ent.* 45 (2), 1960 (188–97). 25 refs. [G.g.e.] O.H.

The author discusses the distinctive characters of 5 members of the *F. rufa* group, considered as separate species. In addition to the number and position of bristles on head and thorax, *F. rufa s.s.* and *F. polyctena*, both polygynous species suitable for artificial colonizing, both possess a distinctive highly persistent odour, independent of food and environment, which is recognizable by the insects of both species, even in the form of alcohol or ether extracts from worker ants. As these species are hostile to each other and fight to extinction, it is important to use only one or the other in any one locality.

3422. KOROL′KOVA, G. E. Opyt izučenija vozdejstvija ptic na čislennost′ massovyh nasekomyh-vreditelej dubrav. **[The effect of birds on the numbers of insect pests in Oak forests.]** *Trud. Inst. Les.* No. 35, 1957 (137–60). 5 refs. [Russ.]

Reports results of studies in the Tellerman forest on the effect of birds on the numbers of *Lymantria dispar*, *Malacosoma neustria*, *Euproctis chrysorrhoea* and *Operophtera brumata*.

3423. KRZANOWSKI, A. Ergebnisse des Waldfledermausschutzes auf Grund fremder und eigener Erfahrungen. **[Results of bat protection, based on observations by the author and others.]** *Waldhygiene* 3 (3/4), 1959 (99–105). 21 refs. [G.]

A review of experiences with nesting boxes, discussing factors of population dynamics (climatic rather than ecological limitations) that prevent rapid increases of bat populations or marked effects on insect populations.

### Insects: Chemical Control (General)

See also Nos. 3254, 3406–8, 3443, 3445, 3447, 3457, 3465, 3469, 3473–4, 3478–9, 3483–4, 3510.

3424. SANGER, A. M. H. **Aldrin, dieldrin and endrin: effects on soil micro-organisms. The literature surveyed.** *Span, Shell Public Health & Agricultural News, London* 3 (1), 1960 (37–9). 34 refs.

A review of literature—mainly from English-language sources. [Cf. *F.A.* 17 No. 599; 20 No. 2057.]

3425. DAHL, J., and PETERSEN, B. B. Om virkningen af kemisk skadedyrbekæmpelser på insekter og spindler i en granskov. **[The effect of chemical control measures [against *Pristiphora abietina*] on insects and arachnids in a Spruce forest.]** *Forstl. Forsøgsv. Danm.* 26 (2), 1960 (271–312). 4 refs. [Dan.e.*e.*]

In 1950, 1951, and 1955, studies were made on the effect on the rest of the arthropod fauna of applying chemicals—parathion, derris, quassin, and Bladan [hexaethyl tetraphosphate]—from the air or the ground, in various concentrations, to control *P. abietina*. Results are tabulated. It is emphasized that limitations of material and time do not permit of more than provisional conclusions. The effect of quassin was too slight to be determined but the other chemicals had some effect, particularly parathion. The groups most affected were Diptera, Hymenoptera and Copeognatha. The complete elimination of any single species by control measures seems improbable. No mortality among birds or mammals was observed.

### Orthoptera

3426. HADLINGTON, P., and HOSCHKE, F. **Observations on the ecology of the phasmatid *Ctenomorphodes tessulata* (Gray).** *Repr.* from *Proc. Linn. Soc. N.S.W.* 84 (2), 1959 (146–59 + 2 plates).

This insect is a defoliator of trees in the coastal forests of northern New South Wales, where it reached outbreak proportions during 1955–56. Its known range is from Colombatti State Forest, near Kempsey, N.S.W., to Goodwood, near Maryborough, Queensland. Attack appears to be restricted to some of the drier coastal hardwood forests, and outbreaks have been recorded only from New South Wales. *C. tessulata* has attacked a wide range of species of the genera *Eucalyptus*, *Syncarpia*, *Acacia;* and *Casuarina*, but stand composition in all infested areas shows considerable similarity e.g. attacked stands always have an understorey of *Casuarina torulosa*. Description of adults and eggs, and a key to the nymphal instars are given. The life cycle in the field, laboratory observations and experiments are described. Investigations show that cleptid egg parasites and disease of the phasmatid eggs are regulating factors. The effect of defoliation on forest management is considered. It is suggested that the occurrence of forest fires is followed by an increase in the numbers of *C. tessulata*. The probable effect of fire on the cleptid parasites is also discussed. There appears to be a correlation between the severe fires of 1951–52 and the outbreak of *C. tessulata* in 1955–56. [Cf. *F.A.* 19 No. 2021; 20 No. 2060.] *From authors' summary.*

### Thysanoptera

See also No. 3413.

3427. Sęczkowska, K. Badania nad przylżeńcami (Thysanoptera) stwierdzonymi na polach śródleśnych w okolicach Wandzina. **[Studies on Thysanoptera found in fields among woods near Wandzin.]** *Ann. Univ. M. Curie-Skłodowska, Lublin* 11*C* (7), 1956 (1959), (183–221). 30 refs. [Pol.russ.e.*russ.e.*] C.G.B.

Investigates their occurrence in fields (grain, potatoes, etc.) in relation to the proximity of Pine stands (60 and 7 years old). Woods close to fields may have an adverse effect on the crops by harbouring harmful insects.

### Hemiptera

See also Nos. 2972, 3412–3.

3428. Schindler, U. Die grüne Zikade (*Cicadella viridis* L.), ein Schädling an jungen Laubhölzern. **[*C. viridis*: a pest on young broadleaved species.]** *Forst- u. Holzw.* 15 (3), 1960 (48–50). 2 refs. [G.g.]

Reviews an earlier paper on *C. viridis* [see *F.A.* 15 No. 454], and reports the insect in 1957–59 on ten different broadleaved species near Kassel. The trees most frequently attacked were *Fraxinus excelsior* and *Acer pseudoplatanus*.

3429. Bakke, A. Douglaslusa funnet på Sørlandet. **[*Adelges cooleyi* in Southern Norway.]** *Norsk Skogbr.* 6 (1), 1960 (12). [Nor.e.]

The aphid has been recorded on Douglas Fir and Sitka Spruce near Grimstad on the S. coast, and a slight attack was found on Douglas Fir in E. Agder. These are the first records for Norway.

3430. Cumming, M. E. P. **The biology of *Adelges cooleyi* (Gill.) (Homoptera: Phylloxeridae).** *Repr.* from *Canad. Ent.* 91 (10), 1959 (601–17). 14 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 552).

Presents detailed information on life history, habits, seasonal development, natural control and morphology.

3431. Wylie, H. G. **Observations on *Aphidecta obliterata* (L.) (Coleoptera: Coccinellidae), a predator of conifer-infesting Aphidoidea.** *Canad. Ent.* 90 (9), 1958 (518–22). 21 refs. (*Contr. Div. Ent. Dep. Agric. Can.* No. 3822.) O.R.S.

Notes on distribution, with results of observations made in eastern France on biology, life history, feeding habits, relation to other adelgid predators, and on parasites of *A. obliterata*.

3432. Smith, B. C. **Responses to light and influence of light and temperature on locomotion of the crawler of the Balsam woolly aphid, *Adelges piceae* (Ratz.) (Homoptera: Phylloxeridae), and of insect predators of this species.** *Canad. Ent.* 90 (4), 1958 (193–201). 3 refs. (*Contr. Div. Ent. Dep. Agric. Can.* No. 3700.) O.R.S.

In field tests, the feeding, last-instar, larvae of *Aphidecta obliterata* and *Pullus impexus* covered greater areas of bark than those of *Cremifania nigrocellulata* and *Laricobius erichsonii*, and the locomotor activities of the species were not greatly affected by changes in air temperatures. Adults of *C. nigrocellulata* and *Neoleucopis obscura* made short flights to areas of sunlight at 15 to 25° C., whereas adults of *A. obliterata*, *L. erichsonii* and *P. impexus* did not fly, but remained stationary or walked on the bark surface. These species walked at temperatures ranging from 8 to 25°. The probable sequence of the species in descending order of tolerance of adults to light, on the basis of field observations and laboratory tests, is *N. obscura*, *C. nigrocellulata*, *A. obliterata*, *P. impexus*, and *L. erichsonii*. In laboratory tests, adults, except those of *A. obliterata*, were active from ca. 3 to 22°. The number of times they ceased movement was greater at high intensity than at low for all species except *N. obscura*, and frequency of path-crossing was greater for these 4 species at low light intensity than at high. The walking rate of *A. piceae* in the laboratory was greater at high light intensity than at low, and at the higher test temperatures. *From author's summary.*

3433. Smith, B. C. **Development, feeding habits, and predator-prey relations of insect predators of the Balsam woolly aphid, *Adelges piceae* (Ratz.) (Homoptera: Adelgidae), recently introduced into Canada.** *Canad. Ent.* 90 (8), 1958 (441–9). 8 refs. (*Contr. Div. Ent. Dep. Agric. Can.* No. 3717). O.R.S.

Investigations on insect predators at Fredericton, New Brunswick, indicated that the development of *Aphidecta obliterata*, *Cremifania nigrocellulata*, *Laricobius erichsonii* and *Pullus impexus* on *Adelges piceae* is generally similar to that in Europe. *A. obliterata* attacked *Mindarus abietinus* on the twigs of Balsam Fir. Larvae of *C. nigrocellulata*, *L. erichsonii* and *P. impexus* did not attack *Myzus persicae* or *Pseudococcus* spp., and the prey of these predators are probably confined to the genus *Adelges*. The value of the predators in control of *A. piceae* is limited, because few of their stages attacked the crawler or the sessile first-instar larva. In cage studies in the field, the larvae of the predators reduced the numbers of *A. piceae* appreciably when present before the first-instar larvae became abundant. *From author's summary.*

3434. Clark, R. C., and Brown, N. R. **Predator introductions for Balsam woolly aphid.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 15 (6), 1959 (1).

Notes on the present status of 9 species introduced since 1951: *Laricobius erichsonii*, *Pullus impexus*, *Aphidecta obliterata*, *Cremifania nigrocellulata*, *Aphidoletes thompsoni*, *Exochomus quadripustulatus*, and *Scymnus pumilio*.

3435. Brown, N. R., and Clark, R. C. **Studies of predators of the Balsam woolly aphid, *Adelges***

***piceae* (Ratz.) (Homoptera: Adelgidae). VI. *Aphidecta obliterata* (L.) (Coleoptera: Coccinellidae), an introduced predator in Eastern Canada.** *Repr.* from *Canad. Ent.* 91 (9), 1959 (596–9). 8 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 549.)

*A. obliterata* adults were released on 6 occasions between 1941 and 1955 in New Brunswick, and twice (in 1957 and 1958) in Newfoundland. With summer releases, a complete generation was observed in the field during the year of release, but no recoveries were made in the following year. The reason for the lack of establishment is the inability of the adults to survive winter conditions. *From authors' summary.*

3436. BROWN, C. E. **Dispersal of the Pine needle scale, *Phenacaspis pinifoliae* (Fitch), (Diaspididae: Homoptera).** *Canad. Ent.* 90 (11), 1958 (685–90). 9 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 472.) O.R.S.

In a study of the motility of the Pine needle scale, ♀ nymphs were found to travel ca. 4 times as far as ♂ nymphs. Wind-tunnel experiments showed that nymphs can be transported by air currents; wind-borne nymphs were caught in traps 1¾ miles from the nearest infested trees. *From author's summary.*

### Lepidoptera

See also Nos. 2693–4, 2752, 2866, 3056, 3133, 3412–7, 3420, 3422.

3437. LEMARIE, J. Beitrag zur Kenntnis der Bionomie von *Exoteleia dodecella*. **[Bionomics of *E. dodecella*.]** *Beitr. Ent.* 9 (7/8), 1960 (800–4). 13 refs. [G.g.russ.e.] O.H.

Describes observations on this Pine needle-miner during an outbreak in S. Moravia. Main flight period was from mid-June to July. Each larva mined 2 needles before hibernating, and 1 after hibernating and before attacking 1 or 2 buds in spring. Pupation takes place in a bud in May.

3438. LEMARIE, S. Erster Beitrag zur Kenntnis der Parasiten von *Exoteleia dodecella* L. (Hymenoptera: Chalcidoidea; Proctotrupoidea; Bethyloidea). **[The parasites of *E. dodecella*. I. Chalcidoidea; Proctotrupoidea; Bethyloidea.]** *Beitr. Ent.* 9 (7/8), 1960 (805–9). 9 refs. [G.g.russ.e.] O.H.

Nearly 20 parasitic or hyperparasitic spp. were bred from *E. dodecella*, but only 3 chalcids, *Copidosoma geniculatum*, *Cirrospillus pulcherrimus* and *Tetrastichus turionum* in any great number. *From author's summary.*

3439. STARK, R. W. **Climate in relation to winter mortality of the Lodgepole needle miner, *Recurvaria starki* Free., in Canadian Rocky Mountain Parks.** *Repr.* from *Canad. J. Zool.* 37, 1959 (753–61). 6 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 563.)

In describing the winter climate of an outbreak area of this pest, air masses may be classified in 4 major types—tropical maritime (mT), polar maritime (mP), arctic maritime (mA), and arctic continental (cA). The main circulation is from the N. and W., which results in a predominance of mP and cA air. Local topography and its effect on winter climate are described for 4 areas now sampled on a life-table basis. Variations in winter mortality from year to year, and between sampling areas are related to climate. Extensive invasions of cA air, particularly of long duration, cause lethal winter temperatures. Winter mortality usually occurs during the coldest month, January, and may be exceptionally high when extreme minima of −30° F. to −40° F. persist long enough to depress the monthly mean temperature close to 0° F. However, less extreme temperatures in other months, if unseasonably low, may result in similar high mortalities. [Cf. *F.A.* 15 No. 3799.] *From author's summary.*

3440. STARK, R. W. **Population dynamics of the Lodgepole needle miner, *Recurvaria starki* Freeman in Canadian Rocky Mountain parks.** *Repr.* from *Canad. J. Zool.* 37, 1959 (918–43). 58 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 564.)

*R. starki* has been studied intensively since 1948. Life tables, and survival and death-rate curves show clearly that there are 5 periods in its 2-year life cycle during which extensive mortality may occur: between egg formation and oviposition; between oviposition and larval establishment; during the first and the second larval hibernation; during the spring of moth emergence. Population success is also undoubtedly affected by conditions during the adult life. Population sampling has shown that the outbreak has declined since 1948. Defoliation and increment studies have shown that the period of greatest defoliation occurred in 1940–44, and that the outbreak probably began in the late 1930's. The major cause of the decline was severe winter temperatures, probably during the coldest month. Parasitization was not an important factor, apparently because it also was controlled by winter temperatures. Other natural control features are discussed, as well as the possible effects of climatic factors on oviposition and fecundity. A detailed survey of weather records since 1920 and yearly averages since 1885 suggest that the outbreak of *R. starki* was due to a rise in temperature in the climate of W. Canada. This trend began in the late 1930's, reached a peak in the mid-1940's, and has since declined. It is further postulated that the climate of the Canadian Rocky Mountains is generally too severe for an outbreak of the moth to be prolonged. [Cf. *F.A.* 20 No. 3424; 21 No. 3439.] *From author's summary.*

3441. HARRIS, P. **Life-history and natural control in British Columbia of *Ocnerostoma piniariella* Zell. (Lepidoptera: Yponomeutidae), a needle miner on White Pine.** *Canad. Ent.* 90 (10), 1958 (627–31). 7 refs. (*Contr. Div. Ent. Dep. Agric. Can.* No. 3823). O.R.S.

3442. SCHEFER-IMMEL, V. *Phyllocnistis suffusella* Z. und *Phytomyza* (*Phytagromyza*) *populi* Kltb., zwei blattminierende Pappelschädlinge. **[*P. suffusella* and *P. populi*, two leaf-miners of Poplar.]** *Anz. Schädlingsk.* 33 (2), 1960 (22–4). 5 refs. [G.]

Presents observations on these leaf-miners, which were found causing considerable damage to Poplars (chiefly *Populus* × '*canadensis*') in the Rhine-Main area in the summers of 1958 and 1959.

3443. Kopsacheilis, G. Katapolemēsis tōn entomōn leukēs. **[Control of Poplar insect pests.]** *Das. Chron.* 1 (12), 1959 (541). [Gk.]

Brief report on successful control of *Gypsonoma aceriana* (attacking nursery seedlings of Poplar, especially *Populus nigra* var. *italica*) by spraying with a fresh mixture of BHC, aldrin and Plantex [unspecified] in water.

3444. Trakas, A. Ena blaptikon entomon tōn dasōn. **[An injurious forest insect. [*Gypsonoma* (= *Semasia*) *dealbana* Froel (= *incarnana* Hw.)].]** *Das. Chron.* 1 (10), 1959 (430–1). [Gk.]

Reports the first attacks in Greece by this tortricid, reported earlier in Turkey [at Eskişehir, 1957, on Poplar—cf. *F.A.* 20 No. 4873] and in N. and Central Italy on various broadleaved species, especially Oak.

3445. **Systemics may help control Cottonwood borer [*Gypsonoma haimbachiana*].** *Extr.* from *Rep. Sth. For. Exp. Sta. 1958*, 1959 (48).

In a preliminary study, plants developed from cuttings that had been dipped in a carbon dust containing 44% thimet had an average of 1·1 borers per plant and 0·8 per leader at the end of the first growing season, vs. 39·9 and 17·9 respectively in controls [cf. *F.A.* 20 No. 2072].

3446. Zašev, B. Vývoj obal'ovača šiškového *Laspeyresia* (*Grapholitha*) *strobilella* L. v Bulharsku a jeho škodlivosť na úrode semena roku 1955. **[The increasing importance of *L. strobilella* in Bulgaria, and its damage to the 1955 seed harvest.]** *Lesn. Čas.* 5 (6), 1959 (397–408). 15 refs. [Slovak. russ.g.]

Investigations in the Rhodope Mts. showed that in 1955 all the Spruce were attacked and 96·9% of all the cones contained larvae. The greatest number of larvae found in one cone was 29. Damage was considerably less above 1800 m. alt. By the beginning of winter, 1955, ca. ⅓ of all the seed had been destroyed, and in spring and summer of the following year 73–98%. The quality of seed not directly attacked was also impaired. Measures for reducing damage are discussed.

3447. Martin, J. L. **Chemical control of *Rhyacionia adana* Heinrich.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (1), 1960 (2–3).

Complete control of this insect, which feeds on young Pines from seedling size to 3 ft. in height, was obtained in young plantations of Red and Scots Pine by spraying from a back-pack sprayer with 25% emulsifiable DDT concentrate, mixed 1 part with 9 parts of water. [Cf. *F.A.* 21 No. 710.]

3448. Miller, W. E., and Heikkenen, H. J. **The relative susceptibility of eight Pine species to European Pine shoot moth attack in Michigan.** *J. For.* 57 (12), 1959 (912–4). 5 refs.

Reports on a study made in Ottawa County, Mich., in spring 1958, when *Rhyacionia buoliana* was in the pupal stage. The ratio of insects to shoots was calculated for 10–50 sample trees of each of 8 species growing in 6 mixed plantations aged 8–12 years, and species were grouped according to high (*P. resinosa*), medium (*P. nigra*, *P. ponderosa*, and *P. sylvestris*) or low (*P. strobus*, *P. banksiana*, *P. virginiana*, and *P. rigida*) susceptibility. Counts suggested that the relative susceptibility of Pines may be due to a combination of differential larval survival and differential egg-laying. [Cf. *F.A.* 17 No. 143.]

3449. Watson, W. Y., and Arthur, A. P. **Parasites of the European Pine shoot moth, *Rhyacionia buoliana* (Schiff.), in Ontario.** *Repr.* from *Canad. Ent.* 91 (8), 1959 (478–84). 7 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 518.)

Notes are presented on parasites reared from 4 different stages of the insect's development during the years 1954–56 inclusive. Since *R. buoliana* appeared in Ontario in 1925, 21 indigenous hymenopterous parasites have transferred to it from other hosts, most of them occupying similar habitats. Four indigenous species, *Calliephialtes comstockii*, *Hyssopus thymus*, *Eurytoma pini* and *Itoplectis conquisitor* and one introduced European species, *Orgilus obscurator*, can be considered as common shoot-moth parasites.

3450. Arthur, A. P., and Wylie, H. G. **Effects of host size on sex ratio, development time and size of *Pimpla turionellae* (L.) (Hymenoptera Ichneumonidae).** *Entomophaga, Paris* 4 (4), 1959 (297–301). 7 refs. [E.g.] O.H.

When this parasite, which is used in the biological control of *Rhyacionia buoliana* and *Choristoneura fumiferana*, was bred on large hosts, more ♀s than ♂s developed. On medium hosts, the sex ratio was about 1, and on small hosts ♂s only emerged. Development time and weight of the parasite increased with host size. Possible explanations for these phenomena are discussed.

3451. Bieberdorf, G. A. **Notes on control of the Nantucket Pine moth, *Rhyacionia frustrana* (Comstock).** *Proc. Okla. Acad. Sci.* 39, 1959 (38–9).

Three different insecticides were tested for control of *R. frustrana* in the larval stage. All were applied to branch tips by compressed-air sprayer in a non-phytotoxic isoparaffin oil. The following results were obtained: (1) 0·25% DDT reduced living larvae from 100 to 18·8%, (2) 0·1% dieldrin to 1·58%, and (3) 0·14% compound 4402 (a Shell experimental insecticide 1,2,3,4,5,6,7,8,8-octachloro-3*a*,4,7,7*a*-tetrahydro-4,7-methanophthalan) to 30%.

3452. Basham, J. T., and Belyea, R. M. **Death and deterioration of Balsam Fir weakened by Spruce budworm defoliation in Ontario. Part III. The deterioration of dead trees.** *For. Sci.* 6 (1), 1960 (78–96). 26 refs.

[Cf. *F.A.* 16 No. 4313; 21 No. 717.] This investigation dealt with the fungal and insect-caused deterioration of the merchantable portions, i.e. between stump height and a 3-in. top, of Balsam Fir dying after Spruce-budworm defoliation. It was discovered that 10 insect species and at least 5 species of fungus habitually invade the merchantable boles of these trees, so altering them that they become progressively less suitable for utilization. The general pattern of deterioration consists of a relatively sudden invasion by the insects at or near the time of apparent tree death, and a more gradual fungal invasion which, after 2 years, completely replaces the insects. Evidence has been assembled which indicates that barkbeetles, sawyer beetles, and weevils transport certain deteriorating fungi from dead Balsam Fir to dying trees or trees that have recently died, and that the development of sapwood rot is related to sawyer beetle [*Monochamus scutellatus*] activity. Hence a very close interrelationship was found to exist between the deteriorating insects and fungi. *From authors' summary.*

3453. Cole, W. E. **Sequential sampling in Spruce budworm control projects.** *For. Sci.* 6 (1), 1960 (51–9). 8 refs.

Describes in detail sequential sampling carried out before and after aerial spraying for control of Spruce budworm, covering practical application as well as the theory and analysis involved. [Cf. *F.A.* 16 No. 4287.]

3454. Thomson, H. M. **The effect of a microsporidian parasite of the Spruce budworm, *Choristoneura fumiferana* (Clem.), on two internal hymenopterous parasites.** *Canad. Ent.* 90 (11), 1958 (694–6). 2 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 483.) O.R.S.

A microsporidian occurring together with either of the hymenopterous parasites *Apanteles fumiferanae* and *Glypta fumiferanae* in the same host, does not invade the tissue of the larval parasite, but nevertheless seems to exert an adverse influence on its ability to complete pupation.

3455. Miller, C. A. **The interaction of the Spruce budworm, *Choristoneura fumiferana* (Clem.) and the parasite *Apanteles fumiferanae* Vier.** *Repr.* from *Canad. Ent.* 91 (8), 1959 (457–77). 22 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 541.)

An analysis was made of field data on the density of the parasite, *Apanteles fumiferanae*, the density of the host, *Choristoneura fumiferana*, and the number of hosts attacked, and a mathematical model is presented that will mimic this host/parasite interaction to the extent that 71% of the variation in the number of hosts attacked is explained by the model. The residual variation shows the need for further research along two general lines: (1) field investigations on methods of assessing adult parasite density, and (2) controlled experiments on parasite behaviour and reproduction so as to obtain a better understanding of the coefficients contained in the model and of the extent to which these coefficients are related to the physiology, morphology, or behaviour of the parasite.

3456. Blais, J. R. **Incidence of overwintering parasites in post-outbreak populations of the Spruce budworm in Gaspé.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 15 (6), 1959 (1–2).

Analyses population trends of the two principal parasites, *Apanteles fumiferanae* and *Glypta fumiferanae* in the years 1954–59.

3457. Fettes, J. J. **Control of the Spruce budworm by aircraft spraying and the hazard to aquatic fauna.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (1), 1960 (1–2).

Fisheries biologists have reported extensive killing of young salmon in several catchments on Vancouver Island sprayed at 1 lb. DDT/acre in 1957, and over large areas of New Brunswick sprayed at ½ lb. DDT/acre during recent years. A series of aerial spray tests were accordingly made using: (1) DDD (an analogue of DDT showing some specificity for lepidopterous larvae), (2) Korlan (an insecticide showing a low toxicity for aquatic fauna), (3) Sevin (a new insecticide showing a very low toxicity for fish), and (4) DDT, all at several rates and concentrations. Results indicted that (1), (2), and (3) would not be effective against Spruce budworm in practicable dosages, but that DDT would be effective in dosages as low as ¼ lb./½ gal. water/acre, provided that the spray is distributed to deposit ⩾ 10 drops/sq. cm. over the target area; this dosage is not toxic to fish.

3458. Gregor, F. Zur Eiproduktion des Eichenwicklers (*Tortrix viridana* L.). **[Egg production by *T. viridana*.]** *Zool. Listy, Brno* 9 (1), 1960 (11–8). 11 refs. [G.g.cz.] O.R.S.

Relationships were found between length of ovarioles and size (wing length) of individuals, and between number of eggs and size of individuals or ontogenetic age of the imago. Actual and potential egg production are discussed.

3459. Bel′govskij, M. L. Ustojčivost′ listovertok protiv nizkih zimnih temperatur. **[The resistance of tortricids to low winter temperatures.]** *Soobšč. Inst. Les.* No. 12, 1959 (75–83). 10 refs. [Russ.]

In Oak stands in the Derkul area, the numbers of *Tortrix viridana* were sharply reduced after exceptionally low February temperatures in 1954 (mean air temperature for the month was −19·4° C., and the absolute minimum −32°), whereas those of *Cacoecia rosana* and *C. crataegana* were not. Possible reasons for this are discussed, and it is thought likely that different diapause periods were responsible.

3460. Rennels, R. G. **The natural history of the Zimmerman Pine moth (*Dioryctria zimmermani* (Grote)).** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (5), 1959 (1514). O.R.S.

[Cf. *F.A.* 13 No. 3165; 20 No. 2046.] Presents results of laboratory and field studies on oviposition, population trends, and the life cycle of the moth, and the ecological conditions of infested and uninfested trees and stands. All Pines may be attacked but exotics, e.g. Scots Pine, seem to be favoured and more seriously damaged than natives. Moths attack both leading shoots and tree stems, causing deformation rather than mortality. Point of attack is usually 6–15 ft. above the ground, and infestation is more frequent on the S. sides of trees. The most significant factors influencing severity of infestation seem to be stand density and distance from source of infestation. The % of infestation is highest in open-grown stands and appears to be increased by pruning. Fresh resin masses serve as an indication of active infestation. Dry Septembers seem to encourage and wet ones to inhibit population increase. Injury to stands can be reduced by maintaining full stocking and encouraging early crown closure.

3461. WONG, H. R. **Preliminary notes on the life history of *Herculia thymetusalis* Wlk.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (1), 1960 (3).

Studies on a complex of insect species in the tops of *Picea mariana* in Manitoba and Saskatchewan showed that one of the commonest is a pyralid, *H. thymetusalis*. Ten families with progenies of > 400 specimens were reared in the laboratory, and preliminary findings indicate that it has a 2-year life cycle. [Cf. *F.A.* 21 No. 3414.]

3462. ITO, T., and MUTUURA, A. **[On the *Cryptoblabes lariciana* Mutuura sp. nov. (Lep. Phycitinae) feeding on Larch.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 117, 1959 (1–9 + 3 plates). 12 refs. [Jap.e.]

Life history and biology of a new species attacking the foliage of *Larix leptolepis* in Nagano Prefecture.

3463. WELLINGTON, W. G. **Individual differences in larvae and egg masses of the western tent caterpillar.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 15 (4), 1959 (3–4).

[Cf. *F.A.* 19 No. 702.] Further progress has been made in distinguishing different types of larvae, and in sampling to determine their relative numbers.

3464. MICZULSKI, B. Materiały do znajomości pasożytów niestrzępa głogowca *Aporia crataegi*. **[On insects parasitizing *A. crataegi* pupae.]** *Ann. Univ. M. Curie-Skłodowska, Lublin* 13*C* (8), 1958 (1959), (131–41). 13 refs. [Pol.russ.e.*russ.e.*] C.G.B.

The parasites found were unable to control outbreaks of *A. crataegi*.

3465. CROOKE, M. **Insecticidal control of the Pine looper in Great Britain. I. Aerial spraying.** *Forestry* 32 (2), 1959 (166–96). 17 refs.

[Cf. *F.A.* 20 Nos. 707–8.] An investigation was started in 1952 into the biology and forest status of *Bupalus piniarius*, a potential menace to large areas of Pine plantations reaching vulnerable stages in Great Britain. In 1953 an epidemic was observed at Cannock Chase, the first to be recorded in Great Britain, and in the winter of 1953–54 extensive sampling revealed a number of other Pine forests with abnormally high pupal populations, notably Culbin Forest in Morayshire. The paper gives a detailed account, with two maps and several tables, of the measures taken in 1954 to combat the outbreak at Cannock and to anticipate it at Culbin. It discusses the decision to spray DDT from the air; the delineation of treatment areas; laboratory tests on toxicity; spray droplet size and crown penetration; methods used to select starting date. It describes the spraying operations themselves, the effects of weather, the provision of markers and the subsequent check. The results are given under mortality counts and shoot assessments. Annual pupal counts up to 1957–58 are detailed in two tables. The operation at Cannock is regarded as reasonably successful; that at Culbin was possibly not really needed. Both provided valuable experience for future control work. *From author's summary.*

3466. HEIMPEL, A. M., and ANGUS, T. A. **The susceptibility of certain geometrids to crystalliferous bacteria.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 15 (6), 1959 (2).

Preliminary trials using *Bacillus entomocidus* var. *entomocidus*, *B. thuringiensis* var. *thuringiensis* and *B. thuringiensis* var. *sotto* against the Western Hemlock looper (*Lambdina fiscellaria lugubrosa*) and the Oak looper (*L. somniaria*) were carried out in the laboratory, and limited field trials were also made of *B. thuringiensis* var. *thuringiensis* against *L. fiscellaria fiscellaria*. There is little doubt that all 3 loopers tested are susceptible to crystalliferous bacteria, but the time taken to kill them is significantly longer (100–200 hr.) than that taken to kill other Lepidoptera (e.g. *Malacosoma disstria* 48–96 hr.). In the field, the treatment (spraying with a suspension of 2½ lb./100 gal. of commercial microbial insecticide) caused a reduction of 80–90% in the population in 10 days.

3467. GALLEGO M., F. L. Gusano Geometridae (medidor) de los pinos. **[A geometrid pest of 'Pines'.]** *Rev. fac. nac. Agron., Medellín* 19 (53), 1959 (59–62). [Span.]

Notes on the biology and life-history of *Microcronia trichiata*, a pest of *Cupressus lusitanica* var. *benthami* in Colombia.

3468. GRAHAM, A. R. **Recoveries of introduced species of parasites of the winter moth, *Operophtera brumata* (L.) (Lepidoptera: Geometridae), in Nova Scotia.** *Canad. Ent.* 90 (10), 1958 (595–6). (*Contr. Div. Ent. Dep. Agric. Can.* No. 3796.) O.R.S.

Over 1954–56 the following parasites were released in Nova Scotia, *Cyzenis albicans*, *Agrypon flaveolatum*, *Lypha dubia*, *Phobocampe crassiuscula* and *Pimpla turionella*. No evidence has been found of the establishment of the last three species. *C. albicans* has been found overwintering in Nova Scotia, while *A. flaveolatum* was recovered in considerable numbers the year after release, and may become a more important parasite than *C. albicans*. Optimum dates for release of these two species in Nova Scotia are ca. 5 June (*C. albicans*) and 10 June (*A. flaveolatum*).

3469. Gubar. Rezultati rada na njegovom proučavanju i suzbijanju kod nas u toku 1958 godine. **[Gypsy moth. Results of research and control measures in Jugoslavia during 1958.]** *Zašt. Bilja* No. 52/53, 1959. pp. 184 + 10 plates. Many refs. [Serb.e.g.f.] I.M.I.

A complete issue devoted to *Lymantria dispar* in Jugoslavia, mainly relating to 1958, and containing the following papers: Biometrical analysis of the eggs in geographically distinct populations (*D. Zečević* and *M. Janković*). Predators found in egg masses of *L. dispar* in Jugoslavia during the 1945–50 outbreak (*G. Nonveiller*). Influence of abiotic factors in gypsy moth populations in the Jakovački Ključ forest in 1958 (*M. Maksimović*, *M. Janković*, and *R. Marović*). Parasitic Hymenoptera of the gypsy moth (*K. Vasić* and *S. Salatić*). *Ooencyrtus kuwanai* How. in Jugoslavia (*M. D. Tadić* and *B. Binčev*). [This N. American egg parasite was found in Macedonia in 1958. The source of its introduction and its possibilities for the control of gypsy moth in Jugoslavia are discussed.] Research into the dynamics of gypsy moth populations in localities where no control was undertaken in 1958 (*V. Vaclav*, *E. Georgijevič*, and *D. Lutešek*). Foci of infestation in Bosnia and Herzegovina—*Anastatus disparis* Ruschka as an indicator (*V. Vaclav*, *E. Georgijevič*, and *D. Lutešek*). The occurrence of polyhedral disease in gypsy moth in the course of the first year after the end of an outbreak (*L. A. Vasiljević*). Aerial spraying against gypsy moth (*M. Maksimović*). Aerial control of gypsy moth in the Slavonian forests during 1957 (*I. Spaić*). A survey of the gypsy moth outbreak in Serbia from 1952 to 1957 and the organization of control (*K. Milević*). Forecast of the gypsy moth situation in Jugoslavia during 1959 [by the Federal Commission for Gypsy Moth Control, Belgrade]. Outbreaks in Bosnia and Herzegovina (*D. Hodžistević* and *H. Hadžihelilović*). The diapause in gypsy moth (*K. Vasić et al.*). Comparative ecological investigations into gypsy moth in lowland, hill, and mountain biotopes—annual report 1958 (*D. Zečević*, *L. Janković*. and *P. Sisojević*) Ecological studies of tachinid parasites of the gypsy moth—annual report 1958 (*P. Sisojević*). Density of gypsy moth populations in various localities of Serbia in the first year after the epizootic diseases of the polyhedral type (*L. Vasiljević*). Identifying centres of gypsy moth infestation in Bosnia and Herzegovina during 1958 (*K. Fitze*). Investigations into prepupae and pupae of gypsy moth in Jugoslavia in 1958 (*P. Sisojević*). State of gypsy moth populations in a lowland Oak forest at Jakovaćki Ključ (near Belgrade, Serbia) in 1958—annual report 1958 (*L. Janković* and *P. Sisojević*). Short report on chemical investigations into the active [attractant] substances from the females (*D. Stefanović*, *B. Grujić*, and *P. Prekajaski*). Testing a method of trapping gypsy moth males (*M. Maksimović*). Indicators for forecasting gypsy moth outbreaks (*K. Vasić*, *L. Janković*, and *P. Sisojević*). The effects of the application of highly effective insecticides on the forest biocoenosis (*K. Vasić* and *L. Janković*). [Cf. *F.A.* 20 No. 4895.]

3470. Spaić, I. Prilog poznavanju larvalnog stadija gubara. **[The larval stage of *Lymantria dispar*.]** *Šum. List* 83 (4/5), 1959 (129–33). 15 refs. [Croat.g.]

Reports number and duration of larval stadia, widths of head capsules, number and size of faeces, and colour of larvae and its relation to sex of the adult.

3471. Georgiev, G. Diapauza pri kakavidnija stadij na borovata procesionka (*Thaumetopoea pityocampa* Schiff.). **[Diapause in the pupal stage of *T. pityocampa*.]** *Gorsko Stopanstvo* 15 (1), 1959 (23–6). [Bulg.]

Presents data from several sites in Bulgaria, indicating that a diapause does occur, and discusses the significance of this finding for control measures.

3472. Vago, C. Sur le mode d'infection de la virose intestinale de *Thaumetopoea pityocampa* Schiff. **[The mode of infection in the intestinal virosis of *T. pityocampa*.]** *Entomophaga, Paris* 4 (4), 1959 (311–4). 9 refs. [F.g.] O.H.

Describes the breakdown of the cytoplasmic polyhedra into cocciform fragments and their dissolution under the influence of intestinal fluid *in vitro*, as observed under the electron microscope. [Cf. *F.A.* 21 No. 748.]

### Coleoptera

See also Nos. 2696–8, 2832, 3083, 3288–9, 3412–3, 3415, 3417, 3452.

3473. Allegri. Note préliminaire sur les Capnodes des peupliers. **[Preliminary note on *Capnodis* species on Poplars.]** [*Docum.*] *Int. Poplar Comm., 1st Sess. Wkg. Party on Insects, Rome 1959* No. *FAO/CIP/IN/4* (*Annexe* 1), 1959. pp. 11. [F.]

Discusses systematics, morphology, biology, injuries, prevention and control of these buprestids, usually pests of fruit trees, which have become major pests of Poplars in the near East. *C. miliaris*, *C. tenebrionis* and *C. carrosa* have been reported as attacking Poplars and Willows. Susceptibility appears to vary, but *Populus nigra*, *P. alba*, *P. euphratica* and various Black Poplar hybrids have suffered. Attacks, generally concentrated on the root collar or large roots, are seldom fatal but seriously interfere with growth, causing poor crown development and butt swellings. Two- to three-year stems are liable to windbreak when attacked. The beetles attack only trees of low vigour, and proper establishment and tending, particularly irrigation, are considered the chief preventives. Chemical control of the adults is difficult, owing to the long flight period. The best method appears to be to treat the soil round each tree, after weeding, with an insecticide (BHC, dieldrin, lindane, etc.).

3474. Peterson, L. O. T., and Worden, H. A. **Shelterbelt entomology: Caragana blister beetle, *Lytta nuttalli* Say, investigations.** *Extr.* from *Summ. Rep. Dom. For. Nursery Sta. Sask. 1959*, [1960] (9).

At least 5 species of blister beetle occur on Caragana, the most important being *L. nuttalli.* Trials with a number of insecticides on caged beetles suggest that good control is possible with malathion, diazinon, pyrethrum, and Sevin [unspecified].

3475. Ţeicu, A. Atac de *Cionus fraxini* Deg. în pădurea Verde-Timişoara. **[An outbreak of *C. fraxinus* in the forest of Verde-Timişoara.]** *Rev. Pădurilor* 74 (11), 1959 (669). [Rum.]

Describes an outbreak of epidemic proportions in a mixed Oak/Ash/Elm forest, in which the Ash was almost completely defoliated by this usually relatively harmless insect.

3476. **The large, or common, Pine weevil (*Hylobius abietis* L.).** *Leafl. For. Comm., Lond.* No. 1 (rev.) 1960. pp. 10. Price 1*s*. 0*d*.

Description, notes on life history, hosts, forest relations and control.

3477. Trezesniowski, J. Der grosse braune Rüsselkäfer, der grösste Feind der Fichtenjungkulturen. **[*Hylobius abietis*, the worst enemy of young Spruce plantations.]** *Allg. Forstztg.* 70 (3/4), 1960 (37). [G.]

Suggests that promoting natural regeneration by scarification is both cheaper and safer than planting, as *H. abietis* prefers transplants. In one area, 22% of newly planted 3-year-old stock had been killed by the beetle, while in neighbouring natural regeneration, 2 to 8 years old, no trees had been killed.

3478. Gifford, D. **Notes on Scottish woodland pests: 2. Defoliation of newly planted conifers in Perthshire by *Strophosomus* spp. (Coleoptera: Curculionidae).** *Scot. For.* 14 (1), 1960 (31–3 + 1 plate). 2 refs.

Description of *S. melanogrammus* and *S. capitatus*, which attacked several conifers, especially Scots Pine and Douglas Fir. Dipping planting stock in DDT should give effective protection.

3479. Marty, R. J., and Allison, G. R. **Appraising White-Pine weevil control opportunities.** *J. For.* 58 (3), 1960 (203–6). 5 refs.

Describes the programme of control of *Pissodes strobi* on *Pinus strobus*, planned by the Department of Conservation in New York State, and presents a simple table based on site quality, stocking of crop trees per acre, and weevil injury rate, which allows the calculation of the expected return per dollar spent for control. The highest return on investment in control is on a well-stocked, seriously attacked plantation on a good site, where the value saved will be the greatest. [Cf. *F.A.* 21 No. 2118.]

3480. Francke-Grosmann, H. Beiträge zur Kenntnis der Übertragungsweise von Pflanzenkrankheiten durch Käfer. **[The spreading of plant diseases by beetles.]** *Repr.* from *Verhandlungen des 4. Internationalen Pflanzenschutz-Kongresses, Hamburg 1957* Vol. 1, 1959 (805–9). 7 refs. [G.]

Describes experiments in which barkbeetles, frequently associated with bluestain fungi [cf. *F.A.* 15 No. 1963], were subjected to 6 days' alternate dry and wet conditions, thus eliminating most fungi loosely adhering to them or carried in their intestinal tracts. Those remaining, mostly yeasts but also many bluestain fungi (e.g. *Ophiostoma* spp.), were found chiefly in certain definite locations on the insects' bodies, varying from species to species, but most frequently in fissures or sutures on the elytra where they were embedded in secreta. Usually a mixture of bluestain and/or yeast fungi was found on any one beetle species, though one fungus species often predominated. Only in some cases was a species of beetle specifically associated with one or more species of fungus, e.g. *Myelophilus minor* with its primitive ambrosia fungus *Trichosporium tingens*, and *Ophiostoma canum*. On *Scolytus* spp, known as vectors of Dutch Elm disease, *Ophiostoma* [*Ceratostomella*] *ulmi* was found most abundantly, and also most persistently (i.e. surviving the treatment) on a ribbon of secreta collecting on a row of small hairs on the underside of the elytra. It is suggested that in all these cases a mutual adaptation, similar to that in ambrosia beetles [cf. *F.A.* 21 No. 1102] exists between beetle and fungus, which enables the fungus to survive under adverse conditions—e.g. during hibernation of the beetles in the forest litter.

3481. Nuorteva, M. Untersuchungen über einige in den Frassbildern der Borkenkäfer lebende *Medetera*-Arten (Dipt., Dolichopodidae). **[Some *Medetera* species living in the galleries of barkbeetles.]** *Repr.* from *Annales Entomologici Fennici, Helsinki* 25 (4), 1959 (193–210). 25 refs. [G.]

Discusses systematics, biology, barkbeetle associations etc. of 5 *Medetera* species found in Finland. From the mean numbers of (*a*) *Medetera* larvae found per breeding gallery of *Hylurgops palliatus* (1·75), (*b*) beetle larvae destroyed by fly larvae in feeding tests (7), and (*c*) eggs of *H. palliatus* per breeding gallery (38) it is estimated that *Medetera* larvae destroyed ca ⅓ of the *H. palliatus* larvae.

3482. Nuorteva, M. Loispistiäiset ja päpsiäiset metsiemme suojelijoina. **[Parasitic Hymenoptera and *Medetera* flies as a safeguard to Finnish forests.]** *Metsät. Aikak.* 1959 (12), (436–8). 2 refs. [Fi.e.]

Discusses their biology and their significance in reducing breeding of bark borers. *From author's summary.*

3483. Reisch, J. Abwehr von Borkenkäferschäden. **[Control of barkbeetle damage.]** *Allg. Forstzeitschr.* 15 (12), 1960 (181–3). [G.]

A leaflet recommending practical measures for each season, including, in early spring, spraying of stumps, trap trees and trap heaps and, in some cases, of cut logs, with DDT or BHC, and later in spring or summer, girdling newly infested trees near the base and treating the exposed wood with Xylamon-Schwamm paste (a fungicide containing F). This treatment is stated to kill both the tree and the infesting beetles and larvae, provided that the transpiration stream is not already too much affected, so that felling can be done at a convenient time without precautions regarding bark and slash etc.

3484. Novák, V. Výsledky provozních pokusů s hubením kůrovců v chemicky preparovaných smrcích. **[Results of full-scale trials to control barkbeetles by chemical means.]** *Práce Výzkum. Úst. Lesn. ČSR* No. 16 1959 (61–82 + 4 tbls.). 26 refs. [Cz.cz.russ.g.]

An account of trials in which Na arsenite was painted on girdles round 86 standing Spruce attacked by barkbeetles (*Ips typographus*, *I. amitinus*, *Pityogenes chalcographus*). Results are tabulated in detail. Mortality varied from 51 to 90%. The evidence indicates that this method should be used only as a last resort. [Cf. *F.A.* 15 No. 321.]

3485. CHARARAS, C. Recherches sur la biologie de *Pityogenes chalcographus* L. **[The biology of *P. chalcographus*]** *Schweiz. Z. Forstw.* 111 (1; 2), 1960 (24–40; 82–96 + 1 drawing). 15 refs. [F.f.g.]

Reports on a study in mixed selection forest, 90% coniferous, on Mont Salève (Haute Savoie). Response to attractants and lowered osmotic pressure closely resembled that described for other species [cf. *F.A.* 20 Nos. 3492, 4913]. Trees with pressures of < 2 atm. were not attacked. The main damage is to trees permanently or even temporarily weakened by environmental conditions, Spruce being preferred, particularly the smooth-barked branches and young stems. Associations of *P. chalcographus* with *Ips typographus* and other beetles, swarming behaviour under the influence of temperature and light, breeding behaviour (particularly the problem of polygyny in a population with parity of sexes), generations (2 at lower, 1 at higher altitudes), size and pattern of galleries etc. are discussed. A density of 30 gallery systems/sq. m. of bark is considered lethal.

3486. YOGO, S. **[A survey of the damage by bark beetles in the fourth year after the severe wind storms which visited Hokkaido in 1954.]** *Extr.* from *Ann. Rep. For. Exp. Sta., Hokkaido 1958*, 1959 (143–6). [Jap.e.]

Barkbeetles (*Ips typographus*, *Polygraphus* spp. and *Pityogenes* spp.) and *Monochamus* spp. increased in windthrown trees and adjacent standing timber from 1956 to 1958; over 500 million bd. ft. were killed in 1957. In 1958 numbers dropped to a safe level, probably as a result of overcrowding, natural enemies, and removal of infested trees. Only one infestation peak, instead of the more usual two peaks, was observed in 1958.

3487. YAMAGUCHI, H. **[Ecological researches on the Ezo eight-spined engraver, *Ips typographus* L.f. *japonicus* Niijima with special reference to its reproduction, behaviour and dispersal. II. Re-attack of the adult.]** *Extr.* from *Ann. Rep. For. Exp. Sta., Hokkaido 1958*, 1959 (147–53). 11 refs. [Jap.jap.e.*e*.]

Presents the results of cage experiments. Emergence of ♀s and attack on a second log proved to be related to overcrowding in the original log and to air temperature. Over 50% of the ♀ adults re-attacked and established a second brood. Re-attack was more difficult to observe in the field. [Cf. *F.A.* 21 No. 775.]

3488. REID, R. W. **The behaviour of the Mountain Pine beetle, *Dendroctonus monticolae* Hopk., during mating, egg laying and gallery construction.** *Canad. Ent.* 90 (9), 1958 (505–9). 8 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 452.) O.R.S.

3489. HELLER, R. C., BEAN, J. L., and KNIGHT, F. B. **Aerial surveys of Black Hills beetle infestations.** *Sta. Pap. Rocky Mt. For. Range Exp. Sta.* No. 46, 1959. pp. 8. 8 refs.

Tests were made during 1952 and 1953 in 2 areas, each of > 1000 acres, in the Roosevelt National Forest, to determine whether aircraft might be used in estimating the number of trees killed by *Dendroctonus ponderosae*. It was found that sketchmapping and marking trees on maps and aerial photographs gave poor estimates, save possibly with very light infestations. Surveys covering 50% of the area and using the operation recorder [cf. *F.A.* 13 No. 3162] were successful. Experienced observers can obtain satisfactory results with < 25% error. Aerial photography with panchromatic film (Super XX with orange filter) and small scale (1: 15,840) yielded poor estimates but with Ektachrome Aero film and scale 1: 7920, experienced interpreters were able to count the faded trees on colour transparencies within 5% error. Aerial surveys are best conducted during July and August, when trees attacked in the previous autumn still retain their faded foliage with a colouring still distinguishable from that of trees killed earlier. Colour photography, if completed in late May or June, can be used, in conjunction with control projects, to spot infested and fading trees, which show up clearly on the transparencies.

3490. **Douglas Fir beetle.** *Extr.* from *Rep. Intermt. For. Range Exp. Sta. 1958*, 1959 (20–3).

Though *Dendroctonus pseudotsugae* appeared to prefer trees on the ground (*a*) to standing trees (*b*), galleries in 6 × 12-in. pieces of bark taken from 81 (*a*) trees sampled averaged only 3·7 with a mean length of 17·6 in., against 9 of mean length 37·6 in. in 227 (*b*) trees. Two reasons for this difference may have been (1) that the abundance of fallen trees diluted the available population, and (2) that live standing trees resisted light attacks. Survival of broods during the first 2–3 months however, was 25·6% in (*a*) and only 8·6% in (*b*). Chief parasite was the wasp *Coeloides brunneri*, chief predators *Enoclerus sphegeus* and *Temnochila virescens chlorodia*.

3491. MCMULLEN, L. H., and ATKINS, M. D. **Life-history and habits of *Scolytus tsugae* (Swaine) (Coleoptera: Scolytidae) in the interior of British Columbia.** *Repr.* from *Canad. Ent.* 91 (7), 1959 (416–26). 9 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 545.)

Presents the results of studies made during 1956, 1957, and the spring of 1958. Although the beetle is of little economic importance, a knowledge of its life history and habits is desirable for an understanding of the effects of interspecific competition on the development of *Dendroctonus pseudotsugae*, with which it is often associated in Douglas Fir.

3492. KINGHORN, J. M., and DYER, E. D. A. **Overwintering of ambrosia beetles.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (1), 1960 (4).

Earlier studies have shown that adults of *Trypodendron lineatum* leave their brood logs in late summer, and overwinter in the superficial layer of litter on the ground, the highest concentration being found at the bases of standing trees [cf. *F.A.* No. 4928]. Significant numbers of beetles have now been found hibernating in the outer bark of standing trees (living and dead).

3493. HEIDENREICH, E. Primärbefall durch *Xylosandrus germanus* an Jungeichen. **[Primary**

**attack of *X. germanus* on young Oaks.]** *Anz. Schädlingsk.* 33 (1), 1960 (5–10). 6 refs. [G.g.]

Presents detailed observations on the life history and biology of the borer, based on an attack in a young stand of *Quercus borealis* near Darmstadt. It seems that in favourable circumstances and in special climatic conditions, such as the winter of 1958–59 and the spring and summer of 1959, *X. germanus* can have two generations in one year, and that it can constitute a primary pest. [Cf. *F.A.* 18 No. 3138.]

3494. THOMPSON, G. H. ***Trachyostus ghanaensis* Schedl, (Col., Platypodidae), an ambrosia beetle attacking living Wawa (*Triplochiton scleroxylon* K. Schum.) in Ghana.** *Emp. For. Rev.* 38 (4), 1959 (420–1). 2 refs.

It is suggested that the insect responsible for many of the ambrosia-beetle tunnels found in the wood of apparently sound *T. scleroxylon* logs from Ghana is a recently named species of platypodid, *Trachyostus ghanaensis* Schedl., and not *Chaetastus* (= *Symmerus*) *tuberculatus* (Chap.) [cf. *F.A.* 18 No. 1072]. The application of preventive measures depends on knowledge of the conditions under which the tree becomes susceptible to attack; defoliation by caterpillars of the genus *Anaphe* is a possible predisposing factor. *From author's summary.*

3495. GYÖRFI, J. Beiträge zur Kenntnis der Lebensweise der Engerlinge. **[The life cycle and biology of cockchafer larvae.]** *Z. angew. Ent.* 45 (1), 1959 (87–93). [G.g.e.] O.H.

A general article on the author's observations in Hungary, including a list of 25 species injuring forest plants in that country, the geographical distribution of *Melolontha* strains with different swarming years (presumed to occur in a 3-year cycle for *M. melolontha* and a 4-year cycle for *M. hippocastani*), observations on resistance to frost and waterlogging, infestations in the interior of forests, wild pigs as natural enemies, etc.

3496. BENITEZ MORERA, A. Un enemigo del eucalipto: el coleóptero *Euserica* (= *Serica* Macleay) *mutata* Gyll. **[A pest of Eucalypts (*Euserica mutata*).]** *Bol. Serv. Plagas For., Madrid* 2 (4), 1959 (123–8). [Span.]

Night attacks on the foliage of Eucalypts in the province of Cadiz were traced to a beetle, *E. mutata*, not previously recorded in this region. Some observations are offered on the insect and its habits.

### Hymenoptera

See also Nos. 2699, 3415–6, 3419, 3425.

3497. STYLES, J. H. **Notes on the collection of the adults and the web-spinning larvae of *Cephaleia alpina* Klug (Hym., Pamphiliidae).** *Ent. mon. Mag.* 95 (1142), 1959 (152–3 + 2 photos). 5 refs.

Briefly describes morphology, life cycle, distribution etc. of *Cephaleia alpina* [cf. *F.A.* 17 No. 3074] found in plantations of Japanese and European Larch at Alice Holt (Surrey) established in 1941 and 1932, but not so far in other Larch areas of Britain.

3498. MONTEITH, L. G. **Influence of food plant of host on attractiveness of the host to tachinid parasites with notes on pre-imaginal conditioning.** *Canad. Ent.* 90 (8), 1958 (478–82). 9 refs. (*Contr. Div. Ent. Dep. Agric. Can.* No. 3762.) O.R.S.

Two species of tachinid, *Bessa harveyi* and *Drino bohemica*, were tested on larvae of *Neodiprion lecontei* from *Pinus resinosa* and *P. banksiana*. The parasites preferred *N. lecontei* fed on *P. banksiana* when the selection was made in response to chemotactile stimuli, but showed no preference for the odours of the larvae. The attractiveness to *B. harveyi* of *Pristiphora erichsonii* fed on *Larix laricina* and *L. occidentalis* was also tested. *B. harveyi* showed a preference for larvae fed on *L. occidentalis*. Selection of larvae of these two species by tachinid parasites therefore depends on (1) the insect species, and (2) characteristics acquired by the insects through feeding on a particular tree species. Survival of *D. bohemica* was higher on larvae from *P. banksiana*, but no pre-imaginal conditioning to these larvae occurred in the parasites propagated on them.

3499. FINLAYSON, L. R., and FINLAYSON, T. **Notes on parasites of Diprionidae in Europe and Japan and their establishment in Canada on *Diprion hercyniae* (Htg.) (Hymenoptera: Diprionidae).** *Canad. Ent.* 90 (9), 1958 (557–63). 12 refs. (*Contr. Div. Ent. Dep. Agric. Can.* No. 3816.) O.R.S.

Lists parasites reared from cocoons and eggs collected over 1933–40 in Europe and Japan, and sent to the Belleville laboratory for rearing and release in Canada; also the introduced parasite species that have become established in Canada.

3500. FINLAYSON, L. R., and FINLAYSON, T. **Notes on parasitism of a Spruce sawfly, *Diprion polytomum* (Htg.) (Hymenoptera: Diprionidae), in Czechoslovakia and Scandinavia.** *Canad. Ent.* 90 (10), 1958 (584–9). 8 refs. (*Contr. Div. Ent. Dep. Agric. Can.* No. 3786.) O.R.S.

A total of 64 species of primary and secondary parasites were reared at Belleville from > ½ million *D. polytomum* (37% ♂s) collected in Czechoslovakia and Scandinavia between 1935 and 1939. The most abundant parasites in Czechoslovakia were *Holocremnus ratzeburgi*, *Lamachus marginatus*, *Amblymerus subfumatus*, *Exenterus* spp., *Monodontomerus dentipes*, and *Drino inconspicua*. In Scandinavia the most important were *D. bohemica*, *Blondelia inclusa*, *L. marginatus* and *Lamachus* sp. *From authors' summary.*

3501. UNDERWOOD, G. R. **Parasites of the Red Pine sawfly.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (1), 1960 (2).

Lists 9 species reared from larval collections of *Neodiprion nanulus nanulus*.

3502. STYLES, J. H. **Observations on the spinning of cocoons by larvae of the sawfly *Neodiprion sertifer* (Geoff.) (Hym. Diprionidae).** *Ent. mon. Mag.* 95 (1143), 1959 (178–9). 3 refs.

Reports that in a small outbreak at Strathy Forest, Sutherland, chiefly on *Pinus sylvestris* and *P. contorta* planted in 1949, some late-feeding larvae spun their cocoons on the tips of shoots, mostly of Pines, instead of in the needle litter. These larvae appeared to be a second generation, which so far has not been recorded for this species. Other records of cocoons on foliage, including that of *Larix leptolepis*, are mentioned.

3503. Finlayson, L. R., and Finlayson, T. **Parasitism of the European Pine sawfly, *Neodiprion sertifer* (Geoff.) (Hymenoptera: Diprionidae), in southwestern Ontario.** *Canad. Ent.* 90 (4), 1958 (223–5). (*Contr. Div. Ent. Dep. Agric. Can.* No. 3653.) O.R.S.

Presents a table showing % of parasitization and species reared from cocoons of *Neodiprion sertifer* in the years 1941, 1943, 1946, 1947 and 1949.

3504. Griffiths, K. J. **Observations on the European Pine sawfly, *Neodiprion sertifer* (Geoff.) and its parasites in Southern Ontario.** *Repr.* from *Canad. Ent.* 91 (8), 1959 (501–12). 32 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 550.)

Presents notes on biology and life history. The major difference in parasitization between Ontario and Europe is the absence of egg parasites in Ontario. Pre-spinning larvae are parasitized by *Exenterus* spp. both in Ontario and in Europe. Cocooned pre-pupae are also parasitized to a variable extent both in Ontario and in Europe, although total parasitization reported for European populations is generally higher than that found in Ontario.

3505. Ives, W. G. H. **A technique for estimating Tamarack foliage production, a basis for detailed population studies of the Larch sawfly.** *Repr.* from *Canad. Ent.* 91 (8), 1959 (513–9). 6 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 551.)

Presents a technique for estimating foliage production on *Larix laricina*. Analyses of the data show that the branches should be sampled from 3 crown levels per tree. Stratification of the trees on the basis of crown depth and crown form is recommended. Stratified samples of 6 branches from each of 30 trees should provide satisfactory estimates of the amount of foliage per tree. Foliage weight increases in a linear manner as the season progresses. The effects of this increase on a foliage sampling programme are discussed. *From author's summary.*

3506. Ives, W. G. H., and Turnock, W. J. **Estimation of cocoon populations of the Larch sawfly, *Pristiphora erichsonii* (Hartig).** *Repr.* from *Canad. Ent.* 91 (10), 1959 (650–61). 7 refs.

The first of a series of papers on techniques used in estimating populations of various stages of the Larch sawfly. Two methods of cocoon sampling are described. (1) Soil sampling, in which random soil samples of 1 sq. ft. were examined by hand, and stratified according to crown cover, and topography. Both those factors were found to contribute to significant differences in the number of cocoons per sampling unit. With a sample size of 200, however, both stratified and random sampling gave statistically significant estimates. (2) Trapping fallen larvae. Larvae falling on a standard area were channelled into a box containing suitable cocooning medium. This method has the following advantages over (1): it requires less labour; only the current generation of cocoons are encountered; the total number of cocoons formed can be estimated, whereas in (1) only those containing living larvae are in the main encountered. With (2) it was found that stratification on the basis of crown cover was important only in open stands, and that random sampling gave statistically satisfactory population estimates.

3507. Turnock, W. J. **Emergence of the Larch sawfly, *Pristiphora erichsonii* (Hartig) in relation to soil temperature and weather patterns.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (5), 1959 (1913–4). O.R.S.

Laboratory studies showed that the duration of the post-diapause stage may be altered by varying the temperature (1) immediately after cocoon formation, (2) during cold exposure, and (3) during the post-diapause period, optimum temperature conditions including at least 14 days at 10° C., 200 days at 0–5° and incubation at 15°. Even at these constant temperatures the duration of the stage varied considerably. In bog forests near Prince Albert, Sask., soil temperatures were very variable during the period from disappearance of winter snow to the end of emergence; differences were associated with forest cover, water table, microtopographic variation, and depth beneath the surface, as well as with weather. The number of days from snow disappearance to first emergence proved to increase with anticyclonic activity and to decrease with northward-moving cyclones originating in the Colorado-Wyoming region. Light rains favoured emergence but heavy rains, by raising bog water levels, retarded sawfly development and increased mortality by submerging the cocoons. [Cf. *F.A.* 20 No. 4942.]

3508. **Introduction and establishment of the shrew *Sorex cinereus cinereus* Kerr.** *Extr.* from *Rep. Newfoundld. For. Prot. Ass. 1958/59*, 1959 (81–7).

With a view to the control of the Larch sawfly, 10♂ and 12♀ shrews, obtained from New Brunswick, were released in 1958 in a mixed Larch/Spruce stand near St. George's. During a 3-month trapping period in 1959, 129 animals were captured (12 of the introduced stock and 117 progeny) indicating that the shrew has become established.

3509. Buckner, C. H. **Mortality of cocoons of the Larch sawfly, *Pristiphora erichsonii* (Htg.), in relation to distance from small-mammal tunnels.** *Repr.* from *Canad. Ent.* 91 (9), 1959 (535–42). 8 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 557.)

The study was made on a bog area of eastern Manitoba where small-mammal tunnels were very abundant. Entrance holes occurred at ca. 6-in. intervals. Small mammal predators destroyed in general > 50% of the Larch-sawfly cocoons. Mortality due to this cause was lowest in areas where the shrew *Blarina brevicauda* was the predominant predator, and highest where *Sorex cinereus* was predominant. The majority of cocoons were destroyed within 1 in. of the tunnels. At 3 in. from the tunnels small mammals almost ceased to be a mortality factor. Evidence suggests that *Clethrionomys gapperi* and *S. cinereus* reject dead and parasitized cocoons, though no relationship was found between successful emergence of the parasite *Bessa harveyi* and the distance from tunnels in areas where *S. arcticus* and *B. brevicauda* predominated. Except in one area, small mammal predation was found to be independent of the depth of the cocoons. Most dipterous puparia had not been opened by small mammals. Successful emergence of *B. harveyi* was highest on the dry sites. *From author's summary.*

### Diptera

See also Nos. 3413, 3415–6, 3442.

3510. POSTNER, M. Die Bekämpfung der Tannennadelgallmücke *Agevillea abietis* Hubault (Cecid. Dipt.) unter Berücksichtigung der Parasitierungsverhältnisse. **[Control of *A. abietis*, taking into account the degree of parasitization.]** *Z. angew. Ent.* 45 (1), 1959 (60–5). 22 refs. [G.g.e.] O.H.

Discusses parasitization, particularly by *Platygaster manto*, and suggests that chemical control should only be applied if parasitization is < 10% (i.e. if a speedy natural collapse of the epidemic cannot be expected). In spraying trials in August with 4 organic P preparations on Silver Fir aged 5 and 12–15 years, larval mortality was 100% with the systemics Metasystox at 0·5% (which at 0·1% was ineffective) and Basudin emulsion at 0·1%. Dipterex and Chlorthion forte emulsions at 0·1% were slightly less effective, particularly on the stronger needles of the older trees. [Cf. *F.A.* 20 No. 2115.]

3511. BLAIS, J. R. **Observations on *Rhabdophaga swainei* Felt in the Gaspé Peninsula.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (1), 1960 (2).

This insect develops in galled buds of *Picea glauca*. A number of galls were placed in a rearing chamber and adults emerged from 66·2%, while the remainder produced parasites, notably 2 braconids—*Platygaster* sp. and *Amblymerus* sp. Predation of *R. swainei* larvae and pupae by *Dioryctria reniculella* and *Choristoneura fumiferana* was observed.

### 459. Other Animals

See Nos. 3413, 3415.

### 46. Damage by Man

See also Nos. 3887, 3924.

3512. NAUMENKO, Z. M., and BARANNIKOV, L. F. Sohranenie podrosta pri različnyh sposobah trelevki. **[Survival of advance growth with different methods of skidding.]** *Lesn. Hoz.* 12 (2), 1959 (23–7). [Russ.]

Tabulates the %s of Spruce and Fir advance growth (by height groups < 25, 25–50, 51–100, ⩾ 101 cm.) surviving after (*a*) summer and (*b*) winter skidding in Sakhalin by the following methods: (1) KT-12 tractors (tree-length logs and whole trees); (2) skylines (whole trees and log assortments); (3) winches and ground line (whole trees and tree-length logs); and (4) S–80 tractors (whole trees). The best method was (2), and (*b*) was better than (*a*) in all the methods. The best ground-skidding method was (1), and (4) was the worst.

3513. TOOLE, E. R., and GAMMAGE, J. L. **Damage from increment borings in bottomland hardwoods.** *J. For.* 57 (12), 1959 (909–11). 2 refs.

Logs of *Quercus nuttallii*, *Fraxinus pennsylvanica*, *Celtis laevigata*, *Liquidambar styraciflua* and *Populus deltoides* were dissected 2 growing seasons after increment boring. Though the borer holes callused over rapidly, stain developed round most of them. The mean vertical extent of discoloration was 3–13 in. in 2 years, depending upon the tree species and whether the borings were made in spring or autumn. Horizontal spread was very small. Many samples of stained wood gave no culture, but 6 types of stain fungus and 5 rot fungi were identified. [Cf. *F.A.* 6 p. 29; 11 No. 741.]

### 48. Injuries Due to Unknown or Complex Causes

See also No. 3368.

3514. DAY, W. R. **The influence of pathogenic factors in the rooting space on the development of even-aged plantations.** *Advanc. Sci.* 16 (63), 1959 (212–26). 7 refs. (Also in *Quart. J. For.* 54 (1), 1960 (33–53), and *Emp. For. Rev.* 39 (1), 1960 (38–53).)

Discusses, with some examples from Norway and Sitka Spruce in Britain, the variations in survival and growth rate that occur with varying site water relationships and soil types and depths, and gives illustrations from Britain, Denmark, Holland and Germany of soil conditions in which disease (root infection with or without insect attack) of Sitka Spruce has occurred as a result of deficiencies in the rooting space. Stresses the probability that, on poorer sites, consistent treatment over any appreciable area will be impossible, and that a complex canopy will develop with an understorey, and some degree of debility, if not of obvious disease, in the dominants.

3515. FYSTRO, I. Merkelig misfarging i yteveden hos gran på rot. **[Remarkable discoloration in sapwood of standing Spruce.]** *Norsk Skogbr.* 6 (4), 1960 (123). [Nor.]

A dying tree from a group of 4 or 5, some 30 years old, showing needle loss and discoloration, proved when felled to have a fairly dark bluish-grey discoloration in the outer part of the wood. The cambium seemed to be intact and the part of the growth ring for 1959 already laid down was not discoloured. No fungus was found in cultures of the wood. Chemical tests showed 10 times as much bivalent Fe in the outer as in the normal inner wood. Similar damage has been reported from other parts of Norway and some relationship with the late thawing of the frozen soils in the spring of 1958 is suggested.

3516. WITTICH, W. Über die Ursachen des Kiefernsterbens der letzten Jahre auf schweren Böden. **[The causes of mortality of Scots Pine on heavy soils in recent years.]** *Allg. Forstzeitschr.* 15 (6), 1960 (77). 1 ref. [G.]

Observations in connexion with those by Butin and Reuss [cf. *F.A.* 21 No. 793] on heavy Cretaceous clay, where aeration in the lower layers is usually effected by the deep cracks opening in dry periods. A series of exceptionally wet years interfering with this mechanism had caused the lower roots to die from excess moisture and lack of O, followed by lethal attacks of *Armillaria mellea*, in 20- to 40-year-old stands.

3517. Bolmert, E. Kiefernsterben auf Wasseradern. **[Pine mortality on [subterranean] watercourses.]** *Allg. Forstzeitschr.* 14 (51), 1959 (885). 1 ref. [G.]

The author, a water diviner, states, in support of his theory that the disease described by Butin and Reuss [see *F.A.* 21 No. 793] is primarily a root affection, that all dead and dying Pines in his district were found to be situated on the crossing of two subterranean watercourses.

3518. Parker, A. K. **An unexplained decline in vigor of Lodgepole Pine.** *For. Chron.* 35 (4), 1959 (298–303). 5 refs.

The condition, first noticed in 1957 in southern British Columbia and in two other localities since, affects pole-sized Lodgepole Pine and is characterized by a marked reduction in radial increment, bark lesions, and a general deterioration of the crown. The relationship of the decline to pole blight of Western White Pine (*Pinus monticola*) is discussed. *From author's abstract.*

3519. **Thinning and weeding in relation to disease incidence.** *Extr.* from *Rep. Wattle Res. Inst. S. Afr. 1958/59*, 1959 (13–5).

An experiment was laid out in Nov. 1949 to compare the effect upon yield and disease incidence of different rates of thinning and different methods of weeding. The thinning treatments all left 500 trees/acre at a mean height of 35 ft., involving different frequencies, viz. (*A*) 3, (*B*) 4, (*C*) 7, and (*D*) 6 thinnings; the weeding treatments, after a preliminary clean hoeing when seedlings were about 6 in. high, were (i) no weeding, but Wattle regrowth removed by hand pulling when 2 months old; (ii) weeds and Wattle regrowth removed by hand pulling; (iii) weeds and Wattle regrowth removed by hoeing. In (ii) and (iii) weeding was done 4 times, i.e. when plants were 2, 6, 11 and 15 months old. The experiment was harvested in Jan. 1959, at 9 years old, and data are given on mean d.b.h., bark yield and tannin yield for each treatment. Plots given (i) were not significantly inferior in rate of growth to those weeded 4 times. Plots (iii) had significantly smaller d.b.h. than (ii). There was no significant difference in bark or tannin yield among the three.

There was no significant difference in growth or yields between (*A*), (*B*) and (*C*) thinnings, but (*D*) gave significantly inferior results. It appears that frequent weeding may be a direct cause of gummosis, even though actual root injury is kept to a minimum by hand pulling. It also seems likely that mechanical injury to the root system may have been the cause of the significant differences in mean d.b.h. between (ii) and (iii) at harvesting. The most important finding, however, is that plots given a single weeding at 2 months did not differ significantly in yield from those given 4 weedings. It therefore seems that a considerable saving in weeding costs may be effected without detriment to final bark yield and with every likelihood of reducing the incidence of gummosis. [Cf. *F.A.* 16 No. 3241; 17 No. 1555; 19 No. 1716.]

## 5. FOREST MENSURATION. INCREMENT; DEVELOPMENT AND STRUCTURE OF STANDS. SURVEYING AND MAPPING

See also No. 2625.

### 52. Measurements of Stem Dimensions and Volume of Trees, Stands, Forests and Timber

3520. Drinić, P. Taksacioni elementi bukovih sastojina prašumskog tipa u Donjoj Drinjači. **[Mensuration data of virgin Beech stands in the Donja Drinjaca [Bosnia] area.]** *Rad. Poljoprivred.-Šum. Fak., Sarajevo* (*Šum.*) 2 (2), 1957 (105–40). 12 refs. [Serb.g.]

Tabulates and graphs the following data (per ha.) for some pure virgin Beech stands: height, number of stems, b.a. volume, area of horizontal crown projection, and volume increment.

### 521. Diameter (Girth) and Sectional Area

See also Nos. 3526, 3541, 3542.

3521. Strand, L. 'Relascopisk' høyde- og kubikkmassebestemmelse. **[Determination of height and volume by relascope.]** *Norsk Skogbr.* 3 (20), 1957 (535–8). 3 refs. [Nor.e.]

In the method described, trees having (*a*) a diameter (in cm.), or (*b*) a height (in m.) above eye level, greater than ½ the distance (in m.) from the tree to a line laid out on the ground, are selected by sighting with a relascope of appropriate angle on one side only of, and at right angles to, the line. If the line is 15·7 m. $\left(\frac{10\pi}{2}\right)$ long, the sum of the diameters of the (*a*) trees, divided by 10, gives the b.a./ha. in sq. m.; b.a. × height (i.e. cylinder volume/ha.) is found as $\frac{1}{10}$ of the sum of the squared diameters of (*b*) trees plus a supplement equal to 1·6 m. (eye height) × b.a./ha.; multiplication by a suitable form factor then gives volumes in cu.m./ha. An example is worked out and results are compared with those of enumerations on small sample plots. [Cf. *F.A.* 21 No. 3541.]

3522. Räknetrumma med relaskop. **[A calculating drum for use with the relascope.]** *Skogen* 47 (6), 1960 (124). [Sw.]

The Sifometer, designed by E. Sillerström and C. Fornling, consists of a drum incorporating various circular logarithmic scales working on the slide-rule principle. Values for volume increment %, tree volume, normal stocking/ha. for different ages and site classes, and normal increment % for different ages (from a formula using degree of stand closure, stand age and constants for Pine, Spruce or mixed conifers), etc., can be read from it.

3523. Raghavan, M. S. **A note on the trigonometrical measurement of standing sample trees.** *Indian For.* 86 (2), 1960 (70–9).

Deals in detail with determination of height of tree, crown length, crown width, and diameters of a series of sections, using a Wild theodolite; and enumerates the advantages of this method over the swing-seat.

3524. Avery, G. **An all-purpose cruiser stick.** *J. For.* 57 (12), 1959 (924–5). 4 refs.

Describes the construction of an inexpensive modified Biltmore stick that may be used for (*a*) angle-counts, (*b*) determining diameters and merchantable heights of standing trees, and (*c*) log scaling.

### 522. Height, Length

See also Nos. 3521, 3523–4, 3584.

3525. Mirković, D. Normalne visinske krive za hrast kitnjak i bukvu u NR Srbiji. **[Standard height curves for Sessile Oak and Beech in Serbia.]** *Glasn. Šum. Fak., Beograd* No. 13, 1958. pp. 126. 49 refs. [Serb.*g.g*.]

Based on 205 stands of pure Oak and 560 of pure Beech, chosen at random, and the use of Michailoff's function for determining height/diam. regressions [see *F.A.* 6 p. 197].

## 524. Determination of the Volume of Trees and Stands

### 524.1. Principles of Volume Determination. Form (Taper)

See also No. 3530.

3526. Endacott, N. D. **Stump heights.** *For. tech. Pap. For. Comm. Vict.* No. 2, 1959 (11–2).

Normal undamaged trees of three *Eucalyptus* spp. (within the d.b.h.o.b. range of 11–27 in.) were girthed at 3-in. intervals from ground level to b.h., giving a similar family of harmonized curves. From these, the recent rule that stump height must not exceed half the diameter at top of stump is supported. Adoption of this rule in Victoria should lower stump heights by 7–16 in. and raise the yield per acre by at least 1%. A valuable incidental use of the curves is the estimation of d.b.h. from the stumps.

### 524.3. Volume of Tree Groups and Stands

See also Nos. 3164, 3521–2, 3579, 3901.

3527. Box, B. H. **Construction and use of a quick cruise circular slide rule.** *LSU For. Note La. Agric. Exp. Sta.* No. 35, 1959. pp. 2. 1 ref.

Describes a slide rule based on the conditions prevalent in the South, for quick determinations of per-acre volume in bd. ft. from sample-plot enumerations. [Cf. *F.A.* 19 No. 763.]

3528. Simpfendorfer, K. J. **Tree volume equations.** *For. tech. Pap. For. Comm. Vict.* No. 2, 1959 (15–8).

Discusses and describes preliminary tests to determine the most satisfactory expression of the relation between volume to a 4-in. diam. top o.b. and total height, g.b.h.o.b., and g.o.b. at 15 ft., in the compilation of volume tables for *Pinus radiata*. By using an equation based on g.b.h. and total height only, a satisfactory compromise between maximum accuracy and reasonable ease and time of measuring is achieved.

3529. Schorer. Vorschlag zur Vereinfachung der Massenberechnung. **[Simplified volume determination.]** *Allg. Forstzeitschr.* 15 (12), 1960 (176–7). 3 refs. [G.]

In view of the fact that the 'volume series' of Laer and Spiecker's volume tables [cf. *F.A.* 13 No. 3204] are strictly proportional, it is proposed to base volume determination on one series for each species (working out a table by stem numbers for each diameter class) and to convert this 'basic volume' into true volume by multiplying with a suitable factor—one advantage being that calipering and determination of mean height need not be done simultaneously.

3530. Soest, J. van. **Stem form and volume of Japanese Larch in the Netherlands.** *Uitvoer. Versl. Bosbouwproefsta., Wageningen* 4 (1), 1959. pp. 75 + 1 + 45 tbls. 10 pp. of refs. [E.e.g.du.]

Examines, from the literature, 15 methods of preparing volume tables, and applies them to 518 sample trees, comparing the results. Conclusions drawn include the following: better results are obtained by using the form factor ($f$) rather than the volume, as the dependent variable; $f$ can be estimated equally well from diam. only or from diam. and height, but volume estimated from diam. only leads to considerable inaccuracies; graphical and mathematical methods are of equal accuracy; in practice, $f$ can, for most measurements of standing timber, be derived with sufficient accuracy from a smoothing of $f$ on $d$ or from a mathematical solution using the function $f = a + b \log d_{1\cdot 3}$, although deviation of up to 10% from the regression line can be expected; a considerably better estimate, with a deviation of only 3%, can be obtained from the equation $f = a + b \log d_{1\cdot 3} + b_2 \log d_6 + b_3 \log h$; the data suggest that close initial spacings and medium to heavy thinnings lead to relatively high $f$; the error caused by using the $f$ of the tree with the mean b.a. as the stand $f$ is negligible. It is unlikely that the functions found for Japanese Larch will apply to other tree species. Tables given include volume tables for Japanese Larch, % allowances to be made in estimating commercial volume (i.e. without top and stumpwood) o.b., bark % as a % of o.b. volume, and volume per ha. based on arithmetical mean height and b.a. per ha. (for use with the relascope).

3531. Geōrgoulis, E. B. Problēmata katartiseōs kai chrēsimopoiēseōs onkometrikōn pinakōn histamenōn dendrōn. **[Construction and use of**

**volume tables for standing trees.]** *Das. Chron.* 1 (11), 1959 (473–80). 1 ref. [Gk.]

A single-entry volume table is presented for *Pinus nigra*, based on 300 trees from 3 localities in the Peloponnesus, giving volume in the round (cu.m. u.b.) for 8–63 cm. d.b.h.u.b. in 1-cm. gradations, and also diam./ht. graphs for two different sets of material.

3532. Markić, M., Špiranec, M., and Emrović, B. Tablice drvnih masa za hrast lužnjak u Spačvanskom bazenu. **[Volume tables for *Quercus robur* in the Spačva forest region.]** *Šum. List.* 83 (4/5), 1959 (91–100 + 5 pp. of tbls.). 8 refs. [Croat.g.]

Describes the method of obtaining the necessary data (3231 stems), and appends the tables, by 1-m. ht., and 1-cm. diam., gradations.

3533. Harris, M., and Soediono, J. Tabel volume normal untuk *Anthocephalus cadamba* Miq. (Djabon). **[Normal volume table for *A. cadamba*.]** *Commun. For. Res. Inst., Bogor* No. 69, 1959. pp. 12 + 1 tbl. [Jav.E.]

Based on measurements on 909 sample trees.

3534. Bay, E. Su un metodo grafico per la determinazione della provvigione a mezzo di tavole alsometriche. **[A graphic method of determining the volume of growing stock from yield tables.]** *Monti e Boschi* 10 (12), 1959 (617–22). [It.f.e.]

The method is designed to determine growing stock in a forest under uniform management, comprising even-aged stands of every age from 0 to 120 years.

### 524.4. Recording of Data. Organization of Measuring Parties and Their Work

See Nos. 3577, 3610.

### 524.6. General Surveys of Forests and Whole Tracts of Forest. Partial Enumeration Surveys, Timber Cruising

See also Nos. 3521, 3543, 3546.

3535. Francis, D. A. **Forest inventory in the Sudan.** *Sudan Silva* 9 (1), 1960 (27–32 + 4 photos).

Outlines the work to be done by the recently established Forest Inventory Section at Forest Department Headquarters, Khartoum.

3536. Rao, J. N. K. **Some sampling methods in forest surveys.** *Indian For.* 85 (12), 1959 (723–7). 16 refs.

Summary descriptions of the various sampling methods used at the Forest Research Institute, Dehra Dun.

3537. Bickford, C. A. **A test of continuous inventory for National Forest management based upon aerial photographs, double sampling, and remeasured plots.** *Proc. Soc. Amer. For. 1959*, 1960 (143–8). 5 refs.

Describes an attempt in the Allegheny National Forest to apply a method of continuous inventory based on proposals made by the author in 1952 [cf. *F.A.* 13 No. 4082].

3538. Shiue, C.-J. **Systematic sampling with multiple random starts.** *For. Sci.* 6 (1), 1960 (42–50). 11 refs.

The purpose of the paper is to discuss the advantages of systematic sampling with one random start in forest surveys, and to suggest a modification (systematic sampling with several random starts) designed to provide a valid estimate of sampling error. A set of forest inventory data is used to show the efficiency of the systematic sample.

3539. Grossmann, H. Ergebnisse der im Jahre 1957 durchgeführten Holzvorrats- und Zuwachsinventur im Plenterwald Keula. **[Results of the 1957 inventory of volume and increment in the Keula selection forest.]** *Arch. Forstw.* 8 (6/7), 1959 (667–89). 21 refs. [G.g.russ.e.]

Discusses techniques and results of a survey covering 700 ha. in a Beech selection forest in N. Thuringia. Sampling was systematic, with one circular plot of two concentric circles (½ are for d.b.h. < 15 cm., 3 ares for d.b.h. ⩾ 15 cm.) per ½ ha., on a rectangular grid, giving a 6% intensity. Some comparisons with inventories taken in 1884, 1928 and 1950 are attempted. Increment appears to have been fairly consistent (4·1–4·4 cu.m. p.a.). Accuracy, variation, etc. are discussed for volume and increment.

3540. Richter, A., and Grossmann, H. Untersuchungen über Probekreisgrösse und Netzpunktdichte bei Holzvorratsinventuren. **[Sample plot size and grid density in growing-stock inventories.]** *Arch. Forstw.* 8 (11), 1959 (976–1014). 21 refs. [G.g.russ. e.]

A statistical analysis of accuracy and costs [continuing research reported in *F.A.* 16, No. 3257], based on sample surveys of 300 ha. at Senftenthal and 215 ha. at Spechthausen near Eberswalde. The sizes of the concentric circular plots compared were: ¼, 1 and 4 ares, ½ and 3 ares, ½, 2 and 8 ares, plus a plot of 10 ares, with plot-centre spacing of 100 × 100, 71 × 71, 100 × 50 m., plus variable spacing i.e. differing according to structure and importance of stands, but averaging 2 plots/ha. Greatest efficiency, i.e. greatest accuracy per unit cost was obtained with ½- and 3-are plots and a variable grid in which lines were spaced further apart than sample plots on the lines, the number of plots varying from 4 to ½ per ha. (average 2, sampling intensity 6%) for larger areas.

3541. Grosenbaugh, L. R. **Point-sampling and line-sampling: probability theory, geometric implications, synthesis.** *Occ. Pap. Sth. For. Exp. Sta.* No. 160, 1958. pp. 33. 8 refs.

Demonstrates that Bitterlich's method of b.a. determination by angle-count is one special case of a sampling method, applicable to any property (frequency, growth, value, etc.) in which the probability of a tree's being selected as a sample tree is proportional to the square of its diameter and hence to its b.a. This method, in turn, is one application of the general principle of p.p.s. sampling (p.p.s. denoting 'probability proportional to size'), of which other examples are Hirata's method [cf. *F.A.* 18 Nos. 4382–4], in which selection is proportional to the square of height, and line sampling (l.s.) [cf.

*F.A.* 21 No. 3521], in which selection is proportional to diameter (horizontal l.s.) or height (vertical l.s.). In discussing theory and application, the author gives special attention to sources of error, including slope of ground, lean or elliptical cross-section of trees, and to the procedure to be adopted where trees close to the boundary of the tract surveyed are included in a count, and in the case of doubtful trees. A special tape, graduated to show, for a given sighting angle, the diameters of marginal trees at a given distance, is used to determine inclusion. Other subjects briefly discussed are electronic data-processing, the use of permanent sample points or lines for increment estimates (involving marking of trees originally selected) etc. The chief use of horizontal l.s. is likely to be for estimating the sums of diameters of cull trees (e.g. for poisoning or girdling), and that of vertical l.s. for estimating pole volume in linear feet above b.h., as neither of these involves measurements of selected trees.

3542. SUDIA, T. W. **A comparison of forest ecological sampling techniques with the use of a known population.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (7), 1960 (2468–9). 4 refs. O.R.S.

An 11-acre area of swamp forest interspersed with Beech/Maple forest in Ohio was surveyed and every tree with d.b.h. ⩾ 4 in. was mapped. Sampling trials were made using the plotless-variable-radius method [angle-count], random pairs, 4-yard and 10-yard quadrats, and four transects, two crossing the width and two the length of the area. Each was used to estimate b.a. and number of stems per acre of the total population, for American Beech, Sugar Maple, American Elm, White Ash and Red Maple individually, and for all other species as a single category; these values were compared with those derived from the field record and map. Random pairs gave the best results for both b.a. and stem number with the angle-count method in 3rd and 5th place respectively. The difference between these results and those of Shanks [see *F.A.* 15 No. 3873] suggests that sampling methods devised in one type of forest community may not yield valid information in another.

### 525. Volume by Assortments. Merchantable Volume

See also Nos. 2924, 3360–1, 3550, 3605.

3543. PRIESOL, A. Akostné triedy ako meradlo kvality v hospodárskej úprave lesov. **[Timber quality classes in forest management.]** *Lesn. Čas.* 6 (1), 1960 (8–23). 31 refs. [Slovak.russ.g.]

Describes a method of assessing timber quality classes during enumerations. A visual estimate is made of the timber quality of the lowest ⅔ of the stem (which contains 90% of the stem volume), separately for each half of this length, according to the classes: A—no defects; B—slight defects; C—considerable defects; R—cordwood. Stands can be appraised either by classifying each stem in a complete enumeration, or, preferably, by sampling on a statistical basis. Advice is given on the latter method. [Cf. *F.A.* 17 No. 3131; 18 No. 4414.]

3544. CAMPBELL, R. A. **Tree grades give accurate estimate of second-growth Yellow-Poplar [*Liriodendron tulipifera*] values.** *Sta. Pap. Stheast. For. Exp. Sta.* No. 108, 1959. pp. 14. 3 refs.

Summarizes results of 4 studies based on 236 trees (746 logs) from western N. Carolina. Quality indexes and stumpage values are tabulated by grade, size, and site index. Quality indexes for each grade increased rapidly with size up to 24 in. and somewhat with site index. Estimates on standing trees were 82–85% accurate. [Cf. *F.A.* 12 No. 3491; 21 No. 3760.]

3545. MORRISS, D. J. **Net tree measurement.** *J. For.* 58 (1), 1960 (15–23). 2 refs.

Gives methods for constructing merchantable volume tables, taking into account diameter, usable length, stem form, and % of usable sound material, and describes inexpensive but accurate systems of tree and sample-tree measurement widely used in the southeastern U.S.A.

3546. MORAWSKI, Z. J. R., BASHAM, J. T., and TURNER, K. B. **A survey of a pathological condition in the forests of Ontario.** *Rep. (For. Resour. Invent.) Div. Timb. Ont. Dep. Lds. For.* No. 25, 1958. pp. 96. 19 refs.

The purpose of the survey was to determine cull factors for the main commercial tree species, and to relate them to age and site. Sampling was adequate for *Picea mariana*, *Pinus banksiana*, *Populus tremuloides*, *Acer saccharum* and *Betula lutea*, but further studies should be made on other species, especially *Abies balsamea* and *Picea glauca*. In most species, cull increased consistently with age, and for some species correlation between cull and diam. was also quite strong. Soil moisture appeared to be more closely related to cull in conifers, especially *Picea mariana* and *Pinus banksiana*, than in hardwoods. A tree decadence classification, based on 10 visible defects, and classifying standing tolerant hardwoods into four groups, was used to estimate cull, and proved satisfactory. Mill tests of the application of the hardwood log-grading specifications used showed that these were satisfactory for grade-1 logs, but gave too conservative results for logs of grades 2 and 3. Data for the Boreal and Great Lakes/St. Lawrence forest regions are treated separately. There are tables showing the occurrence of different types of decay and their location, and of different fungi and their association with types of decay for *Picea mariana*, *P. glauca*, *Pinus banksiana*, *Abies balsamea*, *Populus tremuloides* and *Betula papyrifera*, with tables showing fungi associated with stain for the two hardwoods. Detailed results of the survey are given in graphs and tables.

### 526. Log Measurement. Scaling

See also Nos. 3524, 3549.

3547. NISULA, P. Paperipuurankojen kuutioimistaulokoista. **[New volume tables for pulpwood long logs.]** *Metsät. Aikak.* 1959 (12), (438–41). 3 refs. [Fi.e.]

The measuring regulations of 1938 provide that the diameter of pulpwood long logs sold by solid volume must be determined at the middle of the log. Since this system is difficult in practice, volume tables have been produced enabling measuring to be done at the top end. The tables are, however, not suitable for determining volumes of individual logs or of single lots of logs but only for several lots or one lot consisting of logs from many different stands. *From author's summary.*

## 527. Solid Volume of Stacked Products (including Converting Factors)

3548. TUOVINEN, A. 4 m kuusipaperipuunippujen kuutioinnista. **[Calculating the volume of bundles of 4-m. Spruce pulpwood.]** *Tied., Metsäteho, Helsinki* No. 168, 1960. pp. 14. [Fi.e.*e*.]

Comparisons were made of figures for volume of bundles made in a cradle on ice in 1957–59 and those from tables for calculating bundle volume published by Aro in *Commun. Inst. For. Fenn.* 51 (5), 1959. Values from the tables were generally one stacked cu.m. too low, probably because part of Aro's material derived from tractor-sleigh bundling with bundles rectangular in shape and probably poorly rounded, and the rest consisted of very loose bundles lifted from the water by crane after towing, whereas the material bundled in a cradle on the ice was evenly rounded and the length of the tying wire per stacked cu.m. was smaller than that for Aro's material. *From author's summary.*

3549. COULTER, F. A. **Density of *Pinus radiata* logs.** *N.Z. J. For.* 8 (1), 1959 (143–7). 4 refs.

Measurements of weighed lorry loads of logs at Kinleith Mills (all loaded lorries pass over a weighbridge) have enabled density factors to be established, which will permit accurate determinations to be made of the volume of wood coming in. Variations due to dead wood, forest region, age and season are discussed. *From author's summary.*

## 53. Special Measurements of Trees and Stands (Crown Dimensions, Stand Density etc.)

See also Nos. 2676, 3164, 3505, 3523, 3542, 3557.

3550. MACABEO, M. E. **Correlation of crown diameter with stump diameter, merchantable length and volume of White Lauan (*Pentacme contorta* (Vid.) Merr. and Rolfe) in Tagkawayan Forests, Quezon Province.** *Philipp. J. For.* 13 (1/2), 1957 (1959), (99–117). 5 refs.

For purposes of volume estimation by aerial photography, an attempt was made to discover the relation between crown diameter and certain other tree dimensions. From 200 felled trees the following regression equations were established ($X$ = crown diameter in m.): stump diameter in cm. $= 28{\cdot}93 + 4{\cdot}768X$; merchantable length in m. $= 18{\cdot}216 + 0{\cdot}223X$; merchantable volume ($Y$) in cu. m. $= 1{\cdot}915 + 0{\cdot}926X$. $X$ is therefore considered important for determining $Y$, the coefficient of correlation being 0·967. [Cf. *F.A.* 13 No. 1430.]

## 54. Assessment of Site Quality

See also Nos. 3125, 3579.

3551. GAMBI, G. L'indice di Paterson o C.V.P.—punto di incontro tra ecologia ed economica forestale. **[Paterson's or the C.V.P. Index—a meeting place of ecology and forestry.]** *Monti e Boschi* 11 (2), 1960 (78–83). 4 refs. [It.f.e.]

Applies the C.V.P. index [cf. *F.A.* 20 No. 4994; 21 No. 2189] to some Italian climatic data. The resulting site-index figures correspond well with those derived from yield tables, except for sites with a Mediterranean climate.

3552. MØLLER, C. M. Bonitätssysteme. **[Systems for assessing site quality.]** *Allg. Forst- u. Jagdztg.* 131 (1), 1960 (9–17). 27 refs. [G.e.]

A critical comparison of the chief site-class criteria used in yield tables: fixed 10-foot height intervals in Anglo-Saxon countries; vegetation in Finland; total yields/ha. to age 100, increasingly used in Germany and Austria; and physiological proportionality, the system developed and advocated by the author [cf. *F.A.* 13 No. 4073 and *Dansk Skovfören. Tidsskr.* 18, 1933 (457–513)] in which the heights of classes 2, 3, 4 and 5 at a given age are respectively $\frac{7}{8}$, $\frac{6}{8}$, $\frac{5}{8}$ and $\frac{4}{8}$ of Class-I height.

3553. VOMPERSKIJ, S. Ė. O bonitirovanii meliorirovannyh nasaždenij po tekuščemu prirostu zapasa. **[Determining the site class of stands on drained land by the current volume increment.]** *Soobšč. Inst. Les.* No. 12, 1959 (45–9). 4 refs. [Russ.]

The method used is to determine the c.a.i. (volume) and correct it to the density of a normal stand (0·8) as given by density tables. This corrected c.a.i. figure is then used to determine the site class from standard yield tables. The use of the method is illustrated with an actual example (Scots Pine, with some Birch, on peat $\leqslant$ 1·2 m. thick near Leningrad). It is concluded that: (1) the site class determined by this method in the first 10–12 years after drainage is too low; (2) the better the environmental conditions after drainage, the quicker the stand achieves increment rates typical of normal stands under analogous conditions; (3) the method is sufficiently accurate when the stand is $\ngtr$ 20–40 years old at the time of drainage, but if it is older (70–90 years) the site class obtained is considerably too high.

3554. STAGE, A. R. **Site index curves for Grand Fir in the Inland Empire.** *Res. Note Intermt. For. Range Exp. Sta.* No. 71, 1959. pp. 4.

Curves for rating site quality for *Abies grandis*, constructed from the height/age relation of the 25 largest dominants per acre. The units of site index used are height in ft. at a breast-height age of 38 years (ca. 50 years total age).

3555. DAY, M. W., BEY, C. F., and RUDOLPH, V. J. **Site index for planted Red Pine by the 5-year growth intercept method.** *J. For.* 58 (3), 1960 (198–202). 6 refs.

Determines statistically the relationship of (*a*) conventional site index obtained by the height/age method to (*b*) the 5-year growth intercept beginning with the first node above b.h. Data were collected from 56 plots in 40 *Pinus resinosa* stands over a wide range of site conditions in Michigan and Ontario, 10 dominant and co-dominant trees being selected at random within ¼-acre areas. Location, total age, age at b.h., total height, the length of (*b*), and general stand characteristics were recorded. Mean time required for sample trees in each plot to reach b.h. varied from 6·0 to 13·8 years; this was not significently correlated with (*b*), suggesting the influence of factors other than site quality during the period of establishment to b.h. The range of site indices, when determined by (*a*), was 33–88. Over this range, mean (*b*) lengths per plots were 2·51–11·79 ft. A straight-line regression fitted by the least-squares method gave a curve with a slope of $b_{vx} = 5{\cdot}17$. The correlation coefficient, *r* was 0·8939. The slope of the curve and *r* were highly significant. Although the data could not be shown to be significantly different from a straight-line relationship, a curvilinear regression was fitted to the data. For this curve, standard error was 5·66 and *r* highly significant at 0·9180, $r^2$ at 0·8427, indicating that ca. 84% of the variation in total height is associated with variation in the length of (*b*). Thus reliable (*a*) estimates can be obtained by using (*b*). This approach simplifies the task of determining the site index for a given stand, and also permits the determination of site index in young stands, even in those that have grown for only 5 years beyond b.h. [Cf. *F.A.* 19 Nos. 4628–9.] *From author's summary.*

3556. Illingworth, K., and Arlidge, J. W. C. **Interim report on some forest site types in Lodgepole Pine and Spruce-Alpine Fir stands.** *Res. Note B.C. For. Serv.* No. 35, 1960. pp. 44. 8 refs.

Five major and 4 minor sites of Lodgepole Pine in the S. central interior of British Columbia are described. In descending order of site quality, the major ones are: *Cornus*/moss type (CM), *Calamagrostis* type (C), *Calamagrostis*/*Vaccinium scoparium* type (CV) *Calamagrostis*/*Arctostaphylos* type (CA), *Arctostaphylos*/lichen type (AL). Significant relationships between site types and stand data are shown, and successional relationships are briefly discussed. Five principal site types identified in Spruce/Alpine-Fir stands of the Prince George region are described. In descending order of site quality they are: *Oplopanax* type (O), *Disporum* type (D), *Aralia*/*Dryopteris* type (A-D), *Cornus*/moss type (C-M), *Equisetum*/*Sphagnum* type (E-S). Relationships between these site types and stand data are shown. The application of site types and their relation to silviculture and forest management are indicated briefly. *From authors' summary.*

### 56. Increment, Development and Structure of Stands

See also Nos. 2938–41, 2948–9, 2951–2, 2974 *et seq.*, 3092, 3094–3103, 3125, 3136–8, 3142–3, 3144 *et seq.*, 3520, 3539, 3586, 3600.

3557. Matsui, Z. **[The growth of Todo-Fir planted stands and their thinning management.]** *Extr.* from *Ann. Rep. For. Exp Sta., Hokkaido 1958*, 1959 (86–102). [Jap.jap.e.*e*.]

Mean d.b.h. and height for different ages on site classes I–III are presented. A formula is given for determining number of stems per ha. from mean d.b.h. for different thinning grades, and recommendations for thinning are made. *From author's summary.*

3558. Giraud, A. Accroissements comparés de trois futaies: sapins, Douglas et épicéa. **[Comparative increment of three stands: *Abies alba*, *Pseudotsuga taxifolia* and *Picea abies*.]** *For. France* No. 92, 1960 (12, 27). [F.] X.

The three stands were (*a*) naturally regenerated Silver Fir, 50–70 years old, (*b*) planted Douglas, 40 years old, and (*c*) planted Norway Spruce, 40 years old, growing respectively at 750, 850 and 900 m.alt. on the N. slope of Mont St. Rigaud. It is concluded that (*a*) is uneconomic, (*b*) continues to make satisfactory increment, (*c*) should be planted in mixture with Fir, or if planted pure, should be carefully thinned.

3559. Tomaševski, S. Debljinski prirast i vrijeme prijelaza jelovih stabala u fitocenozi bukve s jelom u G. J. Ravna Gora. **[Diameter increment and the recruitment period of Silver Fir in the Beech/Fir community of the Ravna Gora management unit.]** *Šum. List* 83 (6/7), 1959 (176–81). 2 refs.

The culmination of diam. increment occurred at 75–95 cm. d.b.h., followed by a decrease that was more rapid for the higher d.b.h. values. The minimum recruitment period [for 5-cm. diam. classes] coincides with the culmination of diam. increment. In the compartments studied it was 7·5–9·8 years. The effect of aspect on the culmination of diam. increment (this occurred earlier for S. and W. aspects) needs further study. *From author's summary.*

3560. Hoffmann, J. Untersuchungen über das Wachstum der Fichte auf einigen Standortsformen des südöstlichen Thüringer Waldes. **[The growth of Spruce on some site types of the S.E. Thüringer Wald.]** *Arch. Forstw.* 8 (6/7), 1959 (536–91). 29 refs. [G.g.russ.e.]

A field study based on 170 temporary sample plots distributed over 27 site types, combined into 5 groups according to certain site criteria. Patterns of height growth on all groups showed a slowing down between ages 50 to 100 as compared with Wiedemann's tables [cf. *F.A.* 12 No. 1634]. Where number of stems/ha. corresponded to Wiedemann's tables for heavy thinning, mean d.b.h. and b.a.i. were somewhat higher on the better sites.

3561. Nedjalkov, S., and Dakev, T. Rastež i proizvoditelnost na njakoi borovi kulturi kraj Iskreckija sanatorium. **[Growth and yield of some Pine plantations around Iskrec sanatorium.]** *Gorsko Stopanstvo* 14 (6), 1958 (14–7). [Bulg.]

Tabulates height and diameter increment for *Pinus sylvestris* and *P. nigra* var. *austriaca* planted in 1912–14. The condition of the plantations, including ground vegetation and natural regeneration, is discussed. Scots Pine standing volume is 308 cu.m., Austrian Pine 183 cu.m./ha.

3562. Stoffels, A. De lopende jaarlijkse aanwas en de gemiddelde hoogte van grovedennenopstanden in Nederland. [**The current annual increment and mean height of Scots Pine stands in the Netherlands.**] *Ned. Bosb. Tijdschr.* 32 (3), 1960 (87–9). 5 refs. [Du.f.]

Møller's growth law [see *F.A.* 21 No. 834] was found to fit Dutch yield tables for Scots Pine. A table is given showing the calculated c.a.i. for Scots Pine, ages 25–90, mean heights 6–23 m.

3563. Tiam, A. I. **Preliminary study on the growth of Benguet Pine (*Pinus insularis* Endl.) in plantations.** *Philipp. J. For.* 13 (1/2), 1957 (1959), (1–40). 11 refs.

After reviewing previous studies, compares diam. and ht. increment of 5 plantations in Mountain Province, based on estimated size at formation and measurements for 1952 of one 25 × 25 m. plot in each. Growth at the higher elevation, 1500 m., was significantly better (diam. m.a.i. 15·38%, mean ht. 12·49 m., mean diam. 14·20 cm. at 13 years) than at 760 m. (9·09%, 8·73 m., 12·24 cm. at 22 years) despite similar soils. Detailed tables and plot descriptions are appended.

3564. Erteld, W. Der gleichaltrige Mischbestand der Buche mit Esche, Ahorn und Rüster im Muschelkalkgebiet von Nordthüringen. [**Even-aged mixtures of Beech, Ash, Maple and Elm in the shell-limestone region of N. Thuringia.**] *Arch. Forstw.* 8 (6/7), 1959 (495–535). 8 refs. [G.g.russ.e.]

An evaluation of 4 series of permanent sample plots established ca. 45 years ago, now aged 70–106 years and containing 2–17% Ash and 2–12% Maple (or Maple and Elm), discussing b.a., volume, and height development under various treatments. Both Maple and Ash appeared to require fresh sites, rich in nutrients, plus careful tending, in order to compete with Beech. They did better in groups than in stem-by-stem mixtures. Volume production was less in mixed stands than in pure Beech, but value production is thought to be higher.

3565. Kaszkurewicz, A., and Burns, P. Y. **Growth of planted hardwoods on a bottomland terrace site in South Louisiana.** *LSU For. Note La. Agric. Exp. Sta.* No. 37, 1960. pp. 2.

Describes a small mixed stand at the State University Campus, Baton Rouge, aged ca. 30 years. Height m.a.i. exceeded 2 ft. for all species (*Liriodendron tulipifera*, 4 Oaks, and Sweetgum). Volume m.a.i. was greatest for *L. tulipifera* at 2·1 cu. ft., followed by *Quercus nuttallii* which, however, had greatly declined in vigour from age 25.

3566. Tagudar, E. T. **Hagakhak (*Dipterocarpus warburgii*) and Palosapis (*Anisoptera thurifera*) stands in plantation.** *Philipp. J. For.* 13 (1/2), 1957 (1959), (41–61). 14 refs.

Full version of a paper previously published as an abstract [see *F.A.* 20 No. 2174].

## 561. Increment in Height, Diameter, Basal Area, Form and Quality. Variations and Trends; Dendrochronology

See also Nos. 2842, 3513, 3522, 3725–6.

3567. Matérn, B. Några synpunkter på extrapolation av höjdutvecklingskurvor. [**The extrapolation of height-growth curves.**] *Rapp. Kont. Mat. Statist. SkogsforsknInst., Stockh.* No. 2, 1959. pp. 13. 17 refs. [Sw.e.]

Compares the growth curves obtained by (*a*) the distribution function of a logarithmico-normal distribution [Backmann's growth curve—cf. *F.A.* 14 No. 1420] and (*b*) the logistic function with logarithmic time. Concludes that dependable extrapolations are possible only when the observations comprise the principal part of the growth period of the trees, i.e. when extrapolation is no longer needed.

3568. Persson, O. En höjdutvecklingsmodell för björk konstruerad med hjälp av logistikan. [**A model for the height growth of Birch constructed by means of the logistic function.**] *Rapp. Kont. Mat. Statist. SkogsforsknInst., Stockh.* No. 1, 1959. pp. 18 + 3 gphs. 16 refs. [Sw.e.]

Describes the method and discusses the weaknesses of the model (expressed in tables and graphs) obtained from sample-plot data.

3569. Mocanu, V. Auxometrul comparator. [**The dial-gauge dendrometer.**] *Rev. Pădurilor* 74 (10), 1959 (593–4). [Rum.]

Describes and illustrates a casing, designed by the author, into which the dendrometer fits and which has 2 prongs 38 mm. apart, allowing the dendrometer to be applied by hand, at intervals, for remeasurement. An essential accessory is a moulding plane with two grooves 38 mm. apart, with which the bark is smoothed at a point at breast height, leaving two ridges over which the prongs of the instrument fit, and which enable the operator to make remeasurement in the same place. (A number is painted on the stem just above the point of measurement to help in locating it.) It is possible, in this way, to measure increment on a large number of trees with speed and accuracy of ± 0·01 mm.

3570. Trimble, G. R. **Relative diameter growth rates of five upland Oaks in West Virginia.** *J. For.* 58 (2), 1960 (111–5). 13 refs.

Growth data from increment cores of 5 species of Oak growing in unmanaged, well stocked, even-aged stands from 37 to 150 years old were stratified by d.b.h. classes, by site index, and by vigour class (4, based on dominance and crown size). The mean d.b.h. increment of these species over the past 10 years, taken from trees of vigour class I as expressing growth capacity with minimum competition, on typical sites (index 70), gave the following order of increment potential; *Quercus borealis* (2·63 in.), *Q. velutina* (2·37 in.), *Q. coccinea* and *Q. prinus* (2·15 in.), and *Q. alba* (1·76 in.). [Cf. *F.A.* 19 No. 801.]

3571. Holz, D. Über das 'Anfärben' der Jahrringe an Stammscheiben und Bohrspänen. [**Increasing the colour contrasts in annual rings on**

**cross-sections and increment cores.**] *Arch. Forstw.* 8 (8), 1959 (743–9). 5 refs. [G.g.russ.e.]

Discusses various methods, old and new, including: exposure to $NH_3$; slight scorching over a flame; dyeing, and removing the top layer until the zone of differential penetration is reached in which the latewood has retained its natural colour; short dips in concentrated $H_2SO_4$; or over-night soaks in 10% solutions of NaOH or KOH. This last method is considered easy to use and very effective for all species tried (Beech, Oak, Birch, Lime and Poplar) particularly when the solution has been dyed. Though alkalis swell wood more than water does, the difference in radial swelling is considered negligible. Heart- and sapwood reactions for Pine and Oak are also briefly discussed.

3572. MEYER, H. Methode Woropanow zur Ermittlung des Zuwachsprozentes über Merkmale der wechselseitigen Beziehungen zwischen den Bäumen und ihrem soziologischen Milieu. **[Voropanov's method of computing increment % based on indicators of the relation between trees and their sociological environment.**] *Arch. Forstw.* 9 (1), 1960 (19–27). 1 ref. [G.g.russ.e.]

Summarizes and discusses a paper [published in *Trudy Brjanskogo Lesohozjajstvennogo Instituta* 7, 1956 (49–58)], developing a formula $p_v \simeq x\, p_d$ in which $p_v$ and $p_d$ are, respectively, volume and diameter increment %, and $x$ a factor varying according to the position and physiological development of the tree. Values for $x$ varying between 2 and 4 are presented for 6 categories (relating to crown shape and size, and other criteria) of each of 3 classes of upper canopy trees, distinguished by their different physiological development as indicated chiefly by late or early fruiting. Increment %s computed were close to those found by sectional measurement of 70 trees and also to values based on the formulae currently in use in Germany. The practical difficulty is the correct assessment of the morphological and physiological characteristics [cf. *F.A.* 18 Nos. 2688, 4059].

### 562. Volume Increment

See also Nos. 3522, 3574–6.

3573. KOSONOGOV, P. Prirast prebirnih šuma i probne površine kao sretstvo za njegovo određivanje. **[Increment of selection forests, and sample plots as a means of determining increment.**] *Šumarstvo* 12 (7/8), 1959 (329–41). [Croat.f.]

Considers that permanent sample plots are not suitable for increment determination, and advocates rather the construction of increment tables by a method developed [but not explained] by the author himself.

### 564. Forecasting Increment

See also Nos. 3567–8.

3574. KUUSELA, K. Kasvunennusteen suorittaminen hakkuulaskelman yhteydessä. **[Increment forecast in connexion with cutting budget.**] *Acta for. fenn.* 67 (7), 1959. pp. 36. 37 refs. [Fi.e.*e.*]

Using Finnish yield tables and data (tabulated) from a 60-year Pine stand, the 'passage' or 'stand-table projection' method of forecasting increment was compared with two methods, involving the calculation of increment %, generally used in Finland. An obstacle to the use of this method of increment calculation and the allowable cut based on it, is due to the relation between the increment of (*a*) final crop trees and (*b*) trees to be removed by intermediate fellings during the period of forecast. Almost all data available in Finland are from (*a*), and estimate of (*b*) had to be based on insufficient data.

3575. SHIBATA, N. **[Report on volume growth prediction tests carried out on two stands of Japanese Pine [*Pinus densiflora*] at the Takizawa Experimental Forest, Iwate University.**] *J. Fac. Agric. Iwate Univ.* 4 (3), 1959 (259–66). 5 refs. [Jap.e.*e.*] O.R.E.

Pressler's volume-growth % formula (*a*), and stand tables (*b*), were used. In a 25-year stand (*a*) gave the greater volume growth, but in a 45-year stand (*b*) did so.

3576. BUCKMAN, R. E. **The growth and yield of Red Pine in Minnesota.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (5), 1959 (1512). O.R.S.

Growth data from 235 permanent sample plots were used to construct a regression equation for predicting growth (net p.a.i.) and yield (the summation of any number of annual growth increments) of *Pinus resinosa*. The variables used in the equation for predicting b.a. growth/acre were stand density in b.a./acre, age, and site index. Intensity of cutting, number of trees/acre, cutting methods, and variability of diameters showed no relationship to growth. Growth tables were prepared for b.a., cu. ft. volume, and cordwood for site indices 45, 50, 55 and 60, ages 30–160 years, and stand densities of 60, 90, 120, 150 and 180 sq. ft. b.a./acre. Board-foot tables were prepared for the same conditions, but omitting the lower ages. Yield tables were prepared for (1) 'average density' management, in which stand density averages a chosen level midway through a 10-year felling cycle and (2) 'constant beginning-density' management, starting each decade with the same density. Stands of site index 50 with densities of 90, 120 and 150 sq. ft. of b.a./acre were used.

### 565. Sample-Plot Technique

See also Nos. 2899, 3216.

3577. ERTELD, W. Richtlinien für die Anlage und Bearbeitung von langfristigen waldbaulich-ertragskundlichen Versuchsflächen des Instituts für Forstwissenschaften Eberswalde der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin. **[Directives for the establishment and evaluation of long-term sample plots for silvicultural and yield studies of the Forest Research Institute, Eberswalde of the German Academy of Agricultural Sciences, Berlin.**] Institut für Forstwissenschaften, Eberswalde. 1958. pp. 85. 14 refs. [G.]

Practical, detailed instructions to the foresters in charge of the areas where the plots are situated, covering description of site, vegetation and stand, selection and lay-out, measurements and subjective appraisals required, computations of mean height, d.b.h., increment, etc., along with many specimen forms and examples.

### 566. Yield Tables and Their Construction

See also Nos. 3164, 3606.

3578. Osumi, S., and Pardé, J. Le mélèze du Japon: sylviculture et production. [***Larix leptolepis*: silviculture and yield.**] *Rev. for. franç.* 12 (3), 1960 (204–11). [F.]

Gives a table comparing the yield of French plantations with Japanese yield tables, and two sets of curves based on Japanese data, one showing mean height and yield (cu.m./ha.) at 10, 15 . . . 80 years for 5 site classes, and the other showing number of stems/ha. for the same ages and classes.

3579. Bennett, F. A., McGee, C. E., and Clutter, J. L. **Yield of old-field Slash Pine plantations.** *Sta. Pap. Stheast. For. Exp. Sta.* No. 107, 1959. pp. 19.

A study based on sample plots in healthy unthinned plantations aged 9 to 25 years in the Georgia middle coastal plain and the Carolina sandhills, including a volume table [cf. *F.A.* 21 No. 807], a site index table [cf. *F.A.* 20 No. 4997], yield tables by site index, age, and original spacing, etc.

3580. Armăşescu, S. Tabele generale de producţie pentru plopii negri hibrizi din R.P.R. [**General yield tables for hybrid Black Poplars in Rumania.**] *Rev. Pădurilor* 74 (10), 1959 (589–92). 11 refs. [Rum.]

Describes the data and construction of the tables, extracts from which are given for 3 out of the 5 yield classes. Some comparative data from Germany, Czechoslovakia, Bulgaria and Hungary are also given. Tables cover ages 4–26. The Poplars most frequently planted in Rumania are *Populus* × *marilandica* and *P.* × *regenerata*.

### 568. Other Mensurational Studies of Stand Constitution and Changes Therein. Distribution of Growth by Tree Classes etc.

See also Nos. 2917, 2946.

3581. Milojković, D. Istraživanja strukture i zapreminskog prirasta jednodobnih mešovitih sastojina hrasta lužnjaka i belog graba u šumama Gornjeg Srema. [**Structure and volume increment investigations in even-aged mixed Oak/Hornbeam stands in the Gornji Srem forests.**] *Glasn. Šum. Fak., Beograd* No. 15, 1958. pp. 220. 70 refs. [Serb.g.*g.*]

A detailed account of investigations on the influence of Hornbeam on the structure and volume increment of *Quercus robur* stands. It is concluded that mixed stands are more productive than pure Oak; and that they result in better quality Oak wood, Oak having larger crowns and greater drought resistance, better soil conditions, shorter rotations, and greater freedom of choice as to the type and intensity of thinning. The German summary is 24 pages long.

### 58. Surveying and Mapping. Aerial Survey

See also Nos. 2923, 3489, 3537, 3550, 3906.

3582. Becking, R. W. **Forestry applications of aerial color photography.** *Repr.* from *Photogramm. Engng.* Sept., 1959 (559–65). 14 refs.

Discusses the advantages of colour photography. Corrective filters are recommended to reduce colour distortion. Colour quality is adversely affected by haze and by increased flying altitude. The most natural colour balance is obtained on clear mornings without a haze filter, flying at 1500–2000 ft., or with a filter at altitudes of ≯ 5000 ft. Low-altitude photography at scales of 1 : 8000 to 1 : 12,000 has the greatest value for intensive management purposes. Foliage colour has been found very useful for identification, particularly of hardwood species.

3583. Catinot, R., and Saint-Aubin G. de. Utilisation des photographies aériennes sans point au sol en cartographie forestière. [**Utilization of aerial photographs in forest mapping without ground checks.**] *Bois For. Trop.* No. 69, 1960 (17–25). 1 ref. [F.e.span.]

A study of the problem of transforming aerial photographs into sketchmaps useful to foresters, without ground reconnaissance. Two solutions are offered according to whether (*a*) at least two, or (*b*) no astronomical reference points lie within the zone photographed. In (*a*), a method of 'photographic triangulation' is used; in (*b*) contours, watercourses, forest boundaries, etc., are sketched in under a stereoscope; or alternatively mountain ridges and watercourses only. The sketchmaps so obtained have definite, if limited, usefulness. Approximate costs of production are given for scales of 1 : 50,000 and 1 : 25,000.

3584. Hindley, E. **Correction factors for heights of immature trees measured on aerial photographs.** *For. Chron.* 35 (4), 1959 (327–8).

On good photographs, heights of mature trees can usually be measured to an accuracy of ± 5–10 ft., but the author's investigations indicate that height of immature stands cannot be measured with such a constant accuracy, and a variable correction factor is required. Such factors have been worked out, ranging from + 13 ft. for 20 ft. photo-measured height to 0 for 100 ft., for Douglas Fir and Western Hemlock.

## 6. FOREST MANAGEMENT. BUSINESS ECONOMICS OF FORESTRY. ADMINISTRATION AND ORGANIZATION OF FOREST ENTERPRISES

### 61. Forest Management: General, Theory and Principles

See also Nos. 3597, 3601, 3835, 3908, 3923, 3928.

3585. STEPHANOS, A. Kratikai ekmetalleuseis kai dasarcheia protypou dasoponias. **[State exploitation and the model forest ranger district.]** *Das. Chron.* 1 (10), 1959 (389–93). [Gk.]

Includes a brief account of the vicissitudes of forest management in Greece, with their causes. The period just before World War II stimulated silviculture through a realization of the need for self-sufficiency.

3586. CAMERON, R. J. **The management potential of the native forests of North Auckland.** *N.Z. J. For.* 8 (1), 1959 (46–55). 4 refs.

An evaluation has been made of the growth rate in N. Auckland of *Agathis australis*, *Podocarpus totara*, *P. ferrugineus*, *Dacrydium cupressinum* and *Phyllocladus trichomanoides*. The data suggest that the best areas in which to manage these species are not necessarily those in which they are most abundant at present. While only limited areas of forest are likely to prove amenable to intensive management, a much greater acreage could be considered for extensive management as multi-purpose forests. *From author's summary.*

3587. MORRIS, J. Y. **Beech forest types and management potential in North Westland.** *N.Z. J. For.* 8 (1), 1959 (91–100). 8 refs.

Red Beech (*Nothofagus fusca*) is a species of high promise, but pressure for the land on which the best stands occur must ultimately mean that its management will be confined to discontinuous pockets of lower-quality stands, or the extension of the species on land now carrying Hard Beech (*N. truncata*), a rather less valuable species which must, however, be properly managed since it occupies most of the true forest land in the region. Silver Beech (*N. menziesii*) has unquestionable catchment-protection value, but is never likely to be more than a secondary species in forest production, and its management will be undertaken in conjunction with that of Red or Hard Beech. Mountain Beech (*N. cliffortioides*) will probably be managed only for the production of mining timbers, thus saving the more valuable Red Beech for sawlog production. *From author's summary.*

3588. MOULDS, F. R., and BENALLACK, A. L. **Relationship of utilization to forest management.** *For. tech. Pap. For. Comm. Vict.* No. 2, 1959 (7–11).

Discusses the relative importance of these two branches of forestry with respect to plans and developments in the State of Victoria.

3589. GIORDANO, G. De la détermination exacte de la rotation de production maximum des plantations de peuplier. **[The exact determination of the rotation of maximum volume production in Poplar plantations.]** [*Docum.*] *10th Sess. Int. Poplar Comm., Italy 1959* No. *FAO/CIP/95-F Add.* 1, 1959. pp. 5 + 4 gphs. [F.] (Also in *Pubbl. Cent. Sper. Agric. For., Roma* No. 3, 1959 (1960), (181–91). [It.it.e.*e*.].)

Presents a formula for computing the point at which c.a.i. = m.a.i., based on the equation $V = bt^2 + ct^3 + dt^4$ where $b$, $c$, and $d$ are constants and $t$ = total age. Curves and computations are given for clones 'I.214' (a tree aged 10½ years, 4 aged 11, and 2 aged 13½), 'I.154' (4 trees aged 17), and 'I.455' (2 trees aged 10 and 4 aged 17) from 4 plantations at Casale Monferrato, indicating rotation ages between 13 and 18 years (i.e. 11 to 16 years on the site). The formula is stated to give satisfactory results even before the culmination of c.a.i.

3590. BLANCKMEISTER, J. Die räumliche und zeitliche Ordnung im naturnahen Wirtschaftswald. **[Spatial and temporal planning in the management of 'quasi-natural' production forest.]** *Cbl. ges. Forstw.* 76 (4), 1959 (214–32). 12 refs. [G.]

A lecture discussing, with examples, the forest management principles of E. Germany. These aim at replacing the former rigidity of cutting series and rotation age by special planning based on subcompartments formed chiefly with reference to site factors, and a flexible system of exploitation based on physiological maturity and stand quality. [Cf. *F.A.* 18 No. 3601.]

3591. MOLTESEN, P. Fra periodeflader til 'frimærkeskovbrug'. **[From periodic blocks to 'postage-stamp forestry'.]** *Dansk Skovforen. Tidsskr.* 44 (12), 1959 (585–610). 5 refs. [Dan.dan.]

Discusses the tendency towards smaller stands (as working units) in Denmark in the last 50 years, presenting figures indicating that mean size is ca. 0·8 ha., and for Beech and Spruce, the species best represented in the area studied, 1 and 0·6 ha. respectively. Disadvantages of the smaller units include: smaller yield because of edge effects; smaller % of merchantable timber; difficulties in rationalizing exploitation, transport, cultivation, and tending; and increased work in administration. The minimum acceptable size appears to be ca. 0·5–1 ha., and the optimum size for most districts > 3 ha.

### 62. Methods of Management. Working Plans. Annual or Periodic Yield. Yield Regulation

See also Nos. 2932, 2939, 3534, 3574, 3604, 3907.

3592. JOHNSTON, D. R. **A new working plans code in Great Britain.** *Emp. For. Rev.* 39 (1), 1960 (54–60).

The Forestry Commission of Great Britain has recently prepared a new working plans code. This code introduces a form of working plan designed to meet the needs of an expanding forest estate in a period of rapid economic, technological and political development throughout the world. A clear distinction is drawn between short-, medium- and long-term planning and a method has been evolved of adjusting plans to meet changing circumstances without, at the same time, losing sight of the original objectives. The responsibilities towards working plans of the various technical grades within the Commission are clearly defined. The various planning and recording procedures of the new code have been introduced at all forests although it will take a number of years to complete the surveys and inventories and to write plans for all forests. *Author's summary.*

3593. **Symposium: 'Predicting forest growth and calculating allowable cut'.** *Proc. Soc. Amer. For. 1959*, 1960 (109–31).

Papers on: Optimum levels of growing stock for managed stands (*G. R. Staebler*); Rotations for managed forests (*L. S. Gross*); Quantification and estimation in future forest management (*L. R. Grosenbaugh*); Calculating allowable harvest cuts in the National Forests of the Northern Rocky Mountain Region (*J. R. Castles*); Growth and the allowable annual cut (*J. F. Bell*); Regulated forest management—southern style (*B. E. Allen*).

3594. ALEMDAĞ, Ş. Ormancılık Araştırma Enstitüsü Büyükdüz Araştırma ormanı serisi orman amenajman planı 1955–64. **[The forest mangement plan of the Büyükdüz Forest of the Turkish Forest Research Institute 1955–64.]** *Orm. Araşt. Enst. tek. Bült.* No. 9, 1959. pp. x + 74 + 4 maps. [Turk.e.]

A 10-year plan for this forest (2342 ha.), introducing experimentally many features new to Turkish forest management, e.g. volume of growing stock determined by systematic sampling, increment calculated on trees > 16 cm. d.b.h. by Meyer's method, fellings based on the silvicultural requirements of each compartment (up to limits of the calculated p.a.i.), and introduction of a planned road network. The forest is of the selection type (*Abies bornmuelleriana* 40, *Fagus orientalis* 24, *Pinus nigra* 13, *P. sylvestris* 11, *Quercus sessiliflora* with some *Q. pedunculata* 10, *Populus tremula* 1%), with an excess of overmature stems and good natural regeneration of all species almost throughout.

### 64. Forestry as a Business: General

See also Nos. 2932, 3591, 3598–9, 3609, 3624, 3908–9.

3595. DUERR, W. A. **Fundamentals of forestry economics.** McGraw-Hill Book Company Inc., New York, Toronto, London. 1960. pp. xii + 579. Many refs.

A textbook designed chiefly for the U.S.A. college student, covering in 5 parts (33 chapters) the economics of production and management, the market for forest products, institutions of the forest economy (e.g. tenure, taxes, credit and insurance) and planning (regional, social, national planning, for water, recreation and timber, etc.).

3596. HOLOPAINEN, V. Metsänomistajien osuus yksityismetsien hankinnalla myydyn raakapuun korjuutyöstä. **[The share of the forest owner in extraction work.]** *Metsät. Aikak.* 1959 (12), (431–3). 4 refs. [Fi.e.*e.*]

An analysis of returns from 12,000 private holdings showed that, in the country as a whole, in the 1956–57 felling season, 50% of the logging and 70% of the hauling were done by the owner and his family, the proportion being smaller in southern coastal regions where the area of arable land per farm is fairly high.

### 65. Special Business Problems of Timber-Growing. Calculation of Costs and Profitability. Valuation

See also Nos. 2931, 2936–8, 2942–3, 2954, 3078, 3091, 3122, 3135, 3142, 3148, 3157, 3479, 3608–9, 3625, 3858, 3904.

3597. FRIES, J. Produktion och omloppstid: studier över volymproduktion, värdeproduktion och markvärde grundade på några olika grupper av produktionstabeller. **[Yield and length of rotation: studies on volume and value yields and soil value based on different groups of [Scandinavian] yield tables.]** *Uppsats. Instn. Skogsekon. K. Skogshögsk., Stockh.* No. 3, 1959. pp. 75. 39 refs. [Sw.sw.]

3598. **Survey of private forestry costs: Great Britain. Summary report for forest years 1951–52 to 1955–56.** Departments of Forestry, Universities of Aberdeen and Oxford. 1959. pp. 150. Price 12*s*. 6*d*.

This summary is largely based on the detailed information set out in the Annual Reports of the Surveys published separately by the two Forest Departments for Scotland and for England and Wales respectively [cf. *F.A.* 18 Nos. 2012, 3230–1].

3599. HART, C. E. **Home-grown timber prices and forestry costings.** The Author, Coleford, Glos. 1959 (1960). pp. 23. Price 5*s*.

Includes current prices of round and sawn timber and other forest produce, costs, piece-work rates and contract prices, examples of estimated costs of establishing plantations under Schedule D, prices of plants, and notes on taxation concessions. Figures relate mainly to England and Wales, not Scotland.

3600. CORTY, F. L., and STEVENS, J. J. **Pine planting and profits in North Louisiana.** *Bull. La. Agric. Exp. Sta.* No. 525, 1959. pp. 27.

Includes growth and yield data for planted Loblolly (assuming stable pulp prices and stable or rising timber prices), costs of establishment and management, and computations of profit at 4% compound interest. Cost data include taxes, available planting grants, and soil preparation, but not land rental. Highest net annual return, equal to 8%, is expected from 20- to 25-year pulpwood, or 40-year timber, rotations. It is concluded that, if a person were satisfied with the normal 4% return on a 40-year investment, he could afford to pay $50/acre for land requiring no site preparation before planting.

3601. FEDKIW, J., and YOHO, J. G. **Economic models for thinning and reproducing even-aged stands.** *J. For.* 58 (1), 1960 (26–34). 3 refs.

Economic models are presented which indicate the optimum time (*a*) to thin and (*b*) to regenerate even-aged stands so as to give maximum returns on the owner's capital in a given period of time. Biological and physical thinning guides may be irrational from the economic point of view; thus (*a*) is defined as the time when the volume of trees earning less than the owner's alternative rate (trees which individually are financially mature) constitutes an economically operable cut. Similarly, in most efficient use of land, (*b*) occurs when current annual income per unit area from trees growing at or above the alternative rate falls below the maximum potential mean annual income per unit area from a possible series of new stands; which in turn can be expressed as the annual net worth of future rotations (fixed costs omitted) multiplied by the owner's alternative rate. [Cf. *F.A.* 18 No. 792.]

3602. BAVNGAARD, A. Kulturøkonomiske betragtninger. **[Reflections on the economics of forestry.]** *Dansk Skovforen. Tidsskr.* 45 (1), 1960 (46–83). [Dan.]

Discusses, with particular reference to Tåsinge: relative costs and quality of stands (especially Beech) established by natural or artificial regeneration; economic choice of species; and general treatment (spacing, cleaning, thinning, age of planting stock, etc.).

3603. KUUSELA, K. Kuusikon luontaisen ja keinollisen uudistamisen edullisuusvertailun perusteet. **[A comparison of the profitability of natural and artificial regeneration in Spruce forest.]** *Metsät. Aikak.* 1959 (10), (333–4, 360). [Fi.e.]

Presents data, based on a study of an average Spruce forest in S. Finland, showing the decrease in area needed to produce the same total yield, if natural is replaced by artificial regeneration.

3604. KALLIO, K. Tutkimuksia hakkauslaskelmasta ja siihen perustuvasta metsän tuottoarvosta I. Hakkauslaskelman laatiminen erityisesti metsän tuottoarvon laskemista varten. **[Determination of annual cuts and forest valuations based thereon. I. Determination of annual cuts for the special purpose of computing the rental value of a forest.]** *Acta for. fenn.* 68 (1), 1958 (1959). pp. 54. 41 refs. [Fi.fi.g.*g*.]

A study based on working-plan data of 26 S. Finnish estates of irregular age structure, comparing the effects on yields and stand development (both in terms of quantity and quality), in successive 10-year management periods, of (*a*) an 80-year rotation, (*b*) a 100-year rotation [based largely on Lihtonen, cf. *F.A.* 8 No. 2815] and (*c*) utilizing the maximum allowable cut, taking into account only the restrictions of Finnish forest law. All three would lead to normal age structure within ca. 50 years. The actual amounts cut might vary by as much as 29% of the growing stock in one 10-year period in (*b*) and 82% in (*c*) (in overmature forest) and similar differences might occur in assortments. The effect of these variations on the rental value of a forest estate will form the subject of a second part of the study.

3605. HALLER, K. E. Untersuchungen über die zahlenmässige Erfassung des Wertes stehender Waldbäume am Beispiel der Rotbuche. **[Investigations into quantitative assessments of the value of standing forest trees, using Beech as an example.]** *Mitt. BundesforschAnst. Forst- u. Holzw.* No. 43, 1959. pp. [3] + 67 + 6 tbls. 167 refs. [G.g.]

An investigation into the possibility of constructing value tables of reasonable reliability at reasonable cost, based on analyses of 700 trees from two localities. As a first step, a volume table giving true volumes according to Homa rules [cf. *F.A.* 19 Nos. 2490–1] was constructed, using a modification of Hummel's volume/basal-area line [cf. *F.A.* 16 No. 4377]. Secondly, to facilitate quality assessment, the volume/height relationships (i.e. the populations of total height from the ground corresponding to 25, 50 or 75% of total tree volume) were investigated and tabulated [cf. *F.A.* 18 No. 4414]. From these data, combined with average prices for the main qualities (A, B, C) by diameter classes and cordwood, tables of mean value per cu.m. and mean value per tree are compiled on the basis of separate grading of the lower three-quarters of each tree. To facilitate comparisons, two indexes are proposed, a value index relating mean value per cu.m. to the price of cordwood by a simple ratio, and a quality index established as the ratio of the mean value less the value of the tree as cordwood to the potential maximum value for this diameter class (also less the value as cordwood).

3606. KRIEGER, H. Ertragstafelzweifel und Ostwald-Test. **[Doubts on the accuracy of yield tables, and the Ostwald Test.]** *Forstwiss. Cbl.* 78 (5/6), 1959 (167–74). 1 ref. [G.]

In view of possible doubts as to the general validity of volume yield tables (and thus of money yield tables based on them, investigations were made to show the difference, if any, between the results of 'Ostwald tests' [see *F.A.* 19 No. 2182] with money yield tables based on (1) general and (2) local volume yield tables. Results showed differences to be quite small.

### 66. Costing of Logging Operations

See also Nos. 2937, 3204–5, 3208, 3217, 3224, 3234, 3251, 3611, 3924.

3607. **A method for calculating the cost of owning and operating tractors under 5,000 lbs. GVW.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1924 (*B*-8-*f*), 1959. pp. 4.

### 67. Assessment of Financial Results: Book-keeping and Accountancy; Business Statistics; Short-Term Planning and Financing

3608. SPEER, J. Kostenpreiskalkulation in der Forstwirtschaft. **[Cost accounting in forestry.]** Bayerischer Landwirtschaftsverlag GmbH, Munich. 1959. pp. 39. 16 refs. [G.]

A theoretical discussion of the uses and peculiar difficulties of cost accounting in forestry (its comparative inflexibility, the unavoidable production of various assortments of different value in fairly rigid proportions, etc.). Figures from the Bavarian State Forests, used in illustration, show that if fixed indirect costs are added to direct costs, in proportion to the current prices obtained for the various assortments, only stemwood is produced at a profit, a fact that needs careful consideration in connexion with the frequently advocated adoption of shorter rotations and increased production of pulpwood.

3609. Hiley, W. E., Harley, R. M., and Lehtpere, R. **An examination of the accounts for the years 1955–56, 1956–57, 1957–58.** Dartington Woodlands Ltd., Totnes, Devon. 1959. pp. 18. Price 4*s*.

In addition to the usual report on the years under review, contains a summary of the Company's experiences during the 11 years since its inception.

### 68. Administration and Organization of Forest Enterprises

### 681. National (Federal, State) Forest Services and Administration

See No. 3911.

### 683. Office Organization

3610. Hoffmann, K., and Bolland, G. Über Lochkartenverfahren und ihre Anwendungsmöglichkeiten in der Forstwirtschaft. **[Punched-card systems, and their scope in forestry.]** *Arch. Forstw.* 8 (3), 1959 (181–216). 106 refs. [G.g.russ.e.]

Discusses their uses in forestry documentation and research, and also in calculating wages, tree and plant enumerations, etc.

### 686. Planning and Organization of Buildings, Transport Installations (Roads etc.)

3611. Larsson, G. **Studies on forest road planning.** *Handl. K. Tekn. Högsk.* No. 147, 1959. pp. 137. 18 refs. [E.e.]

Principles for the most economical road spacing, and road standards and the best combination of different types of transport operation are presented. Formulae for minimum cost are deduced, functions elucidated from data collected, and optimum systems calculated for different conditions. *From author's summary.*

3612. Bergkvist, R., and Simonsson, B. Skogliga åtgärder i kraftledningsgator. **[Silvicultural measures on power-line rights of way.]** *Svenska SkogsvFören. Tidskr.* 58 (1), 1960 (1–14). [Sw.sw.]

Discusses establishment and maintenance from the points of view of silviculture (including thinning and topping of adjoining stands, desirable species, etc.), economics, amenity, wildlife, safety, etc. [Cf. *F.A.* 20 No. 3623.]

## 7. MARKETING. ECONOMICS OF TRANSPORT AND THE FOREST PRODUCTS INDUSTRIES

See also No. 3595.

### 72. The Quantitative Aspects of Marketing. Demand, Consumption and Supply

See also Nos. 3203, 3626, 3768, 3796–7.

3613. **Yearbook of forest products statistics 1959.** FAO, Rome. 1959. pp. 157. [E.F.Span.] Price $2.50.

3614. **Homegrown timber.** *Timb. Tr. J.* 232 (4355), 1960: Suppl. pp. xiii–xxxii.

Includes the following papers: Outlook for home-grown timber (*W. F. Middleton*) [discussing necessary departures from the traditional pattern of the trade]; The standing tree (*F. W. Hurry*) [discussing sales by auction, prospects of hardwoods, etc.]; Production in E. Anglian forests (*G. W. Backhouse*); Home-grown timber and research (*E. G. Richards*); Home-grown mining timber supplies (*G. E. Hampson*); Home-grown trade in Scotland (*R. F. Wilson*); Marketing problem of woodland owners (*A. H. H. Ross*); Machinery aids in the woods (*R. G. Shaw*); Some problems of softwood sawmilling (*K. H. S. Walker*).

3615. Žumer, A. Verwertung schwacher Laubholzsortimente. **[Utilization of small hardwood assortments.]** *Schweiz. Z. Forstw.* 111 (2), 1960 (98–116). 14 refs. [G.f.]

A discussion of the present position of supply and demand and future trends in Europe, with special reference to industrial uses of Beech, with statistical data from FAO and other publications.

3616. Mendel, J. J. **Veneer-log production and consumption in the Central States 1958.** *Tech. Pap. Cent. St. For. Exp. Sta.* No. 166, 1959. pp. 5. 1 ref.

3617. Lundgren, A. L. **Farm lumber consumption and use: methods of estimating and results of an east-central Minnesota survey.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (6), 1959 (2069–70). O.R.S.

Methods of sampling are described. In the given area 8·4 million bd. ft. were used, 7·3 for new construction and 1·1 for repair. Twenty-four % of the lumber came from the farmers' own woods, 39% from local sawmills and the rest from dealers. Average use on a single farm was 100 and 500 bd. ft. for repair and new construction respectively.

3618. Hutchison, S. B. **Production-distribution trends and freight rates as they affect Mountain States lumber producers.** *Res. Pap. Intermt. For. Range Exp. Sta.* No. 59, 1959. pp. 13 + 1 map. 3 refs.

Information on where the 8 Mountain States lumber is being marketed, with production and distribution trends and their influence on the region's lumber industry and a comparative analysis of freight rates (showing inconsistencies) and their effect on marketing.

3619. Ervasti, S. Suomen havusahatavaranmyynnin kausi- ja suhdannevaihteluista vuosina 1951–1958. **[The seasonal and business cycle fluctuations**

**of Finnish sawn softwood sales 1951–58.]** *Acta for. fenn.* 68 (2), 1959. pp. 28. 7 refs. [Fi.e.*e.*]

3620. OREŠČANIN, D. Die Entwicklung der jugoslawischen Holzausfuhr. **[The development of Jugoslavian exports.]** *Holz-Zbl.* 86 (7), 1960 (61–3). [G.]

Presents data on post-war developments by products and destination. The general trend is towards a relative increase in the % of manufactured products, including pulp and plywood. [Cf. *F.A.* 21 No. 884.]

3621. LUR'E, N. A. Vnešnjaja torgovlja SSSR lesomaterialami. **[Forest products exports of the U.S.S.R.]** *Lesn. Prom.* 1959 (12), (28–9). 1 ref. [Russ.]

Data for 1957 and 1958, taken from a Soviet statistical handbook on U.S.S.R. exports, including amounts, assortments, value, and importing countries.

3622. LATHAM, B. **Takoradi and timber.** *Emp. For. Rev.* 38 (4), 1959 (341–7).

Describes the port of Takoradi, and gives details of timber transport and trade in Ghana, with statistics of output, export destinations, species used, and seasonal fluctuations in stocks at the harbour.

3623. GALLANT, M. **Report to the Government of Sarawak on the export of Ramin [*Gonystylus* spp.].** Expanded Technical Assistance Program, FAO, Rome. *FAO Report* No. 1189, 1960. pp. 30. [E.]

Discusses the extent and likely stability of the trade, the end-use of the timber, and its availability.

### 73. Prices

See also No. 3599.

3624. HOLOPAINEN, V. **The concept of a roundwood price level and its determination in forestry.** *Acta for. fenn.* 68 (6), 1959. pp. 13. 6 refs. [E.fi.]

Analyses an investigation into roundwood prices in central Finland by stratified sampling (stratification on the basis of size of holdings), where the number of holdings was 17,246 and the size of sample 1227. Formulae are quoted for the determination of mean prices and for calculating (*a*) assortment indices and (*b*) a general index. The basis for (*b*) should be the price obtained by dividing the total sales revenue from different timber categories by the quantity sold in cu.m. Though regional differences could be eliminated by weighting, correct interpretation of unrestricted price statistics was recommended as simpler.

### 74. Trade Policy

3625. **Report of the Timber Inquiry Committee, 1959. Books I & II.** [Minister for Public Lands and Irrigation, Brisbane.] 1959. pp. 83 + 119.

Covers sawn timber and plywood prices in Queensland, and the relationship between them and log prices charged by the Crown; and the timber sales policy and sawmill licensing policy of the Queensland Department of Forestry.

### 78. Economics of Transport

See Nos. 3203, 3618, 3622.

### 79. Economics of the Forest Products Industries

See also Nos. 3835, 3886.

3626. Der Holzverbrauch der holzbearbeitenden Industrie in den Forstwirtschaftsjahren 1951, 1954 und 1958. **[Wood consumption by wood-using industries [in W. Germany] in the forestry years 1951, 1954 and 1958.]** *Holz-Zbl.* 86 (5), 1959 (42). [G.]

Presents tables and diagrams for saw-, veneer- and plywood mills, and fibre- and particle-board factories. There were substantial increases in the use of foreign woods in veneer and plywood mills and of residues in composite-board manufacture.

3627. **Final report of the World Consultation on Pulp and Paper Demand, Supply and Trade, Rome, 14–19 September 1959.** FAO, Rome. No. *FAO/WPPC*-59/27, 1959. pp. 24 + 4. [E.] Limited distribution. F.C.A.H.

Includes data on current and anticipated demand and current production for the different regions of the world.

3628. Grupo asesor en papel y celulosa para América Latina. La industria peruana del papel y la celulosa: situación actual y tendencias futuras. **[Advisory group on pulp and paper for Latin America. The Peruvian pulp and paper industry: present situation and future tendencies.]** FAO, Rome. No. *FAO/ETAP*/1116, 1959. pp. iv + 51. [Span.] Limited distribution.

Presents information on production, imports, consumption, future demands and possibilities for expansion.

3629. Grupo asesor en papel y celulosa para América Latina. Estudio del papel y de la celulosa en el Ecuador. **[Advisory group on pulp and paper for Latin America. Study of pulp and paper in Ecuador.]** FAO, Rome. No. *FAO/ETAP*/1118, 1959. pp. iii + 26. [Span.] Limited distribution.

Presents data on the present situation in Ecuador, including resources, production, consumption and imports.

3630. Grupo asesor en papel y celulosa para América Latina. La industria del papel y la celulosa en Venezuela. **[Advisory group on pulp and paper for Latin America. The pulp and paper industry in Venezuela.]** FAO, Rome. No. *FAO/ETAP* 1115, 1959. pp. iii + 28. [Span.] Limited distribution.

Presents information on the present state of the industry, production, resources in raw materials, future demand, imports, and possibilities for the future.

## 8. FOREST PRODUCTS AND THEIR UTILIZATION

See also No. 3923.

3631. **Annual review issue.** *For. Prod. J.* 10 (2), 1960 (57–122). Many refs.

Reviews of progress based largely, but not exclusively, on recent American literature and covering logging (*L. N. Ericksen*) [see separate abstract], glues and gluing (*R. F. Blomquist*), wood preservation (*C. S. Walters*), wood drying (*J. M. McMillen, et al.*), chemical utilization (*I. A. Pearl* and *J. W. Rowe*), wood finishing (*D. G. Lubeck*) and veneer and plywood (*J. F. Lutz*).

3632. MAYER-WEGELIN, H., and MAMMEN, E. Holzeigenschaften und Holzverwendungen. **[Wood properties and uses.]** *Repr.* from *Grundlagen der Forstwirtschaft*. M. & H. Schaper, Hanover. 1959. pp. 1023–65. 47 refs. [G.]

Includes lists of native and exotic timbers, their properties and uses, sections on physical, chemical and mechanical properties, defects, testing, preservation and various uses, including composite boards, etc., with many tables, lists of German standards, and alphabetical lists of chief terms with definitions.

3633. **[The wood industry in Japan and abroad.]** *Wood Ind., Tokyo* 14 (12), 1959 (1–44). Many refs. [Jap.] P.R.

Many review articles and miscellaneous notes [in Japanese] on the wood industry in Japan, U.S.A., and N. Borneo. A paper by *H. Kanazawa* (in Japanese with English summary and legends), giving the results of a study on the adhesion process of 25 commercial urea-formaldehyde adhesives in the manufacture of wooden clogs [11 hardwood and softwood species listed], is included.

3634. **[Development of the Japanese wood industry.]** *Wood Ind., Tokyo* 15 (1), 1960 (1–56). Many refs. [Jap.] P.R.

Includes review article (in Japanese with English titles) by different authors on various aspects of the Japanese wood industry. An original paper by *Y. Tanaka* (with English summary), describing and discussing experiments on veneer cutting of Sugi with a slicer, is included.

3635. **[Japanese timber and woodworking industries.]** *Wood Ind., Tokyo* 15 (2), 1960. pp. 48. Many refs. [Jap.] P.R.

A collection of (mainly) review articles (English titles listed) dealing with: the flooring industry, timber drying practices, use of laminated wood in motor cars, the finishing of furniture, manufacture of particle board, and including an article by *K. Tsuchiya* and *K. Kitahara* (with English summary), dealing with original research on the moisture-proofing of *Chamaecyparis obtusa* with various lacquers, paints and varnishes.

3636. **[Japanese wood industry.]** *Wood Ind., Tokyo* 15 (3), 1960. pp. 54. Many refs. [Jap.] P.R.

Comprises miscellaneous articles and reviews by different authors, dealing with various aspects of the wood industry in Japan [English titles given]. An original research paper by *T. Murayama* (with English summary), on the effect of Ti compounds on the dimensional stability of wood, is included.

3637. FLEMMICH, C. O. [Editor]. **Timber utilisation in Malaya.** *Malay. For. Rec.* No. 13, 1959. pp. viii + 141 + 32 plates, 1 map.

The original handbook, published in 1950 [cf. *F.A.* 2 p. 300], has been revised and expanded, and now contains the following chapters: Forestry in Malaya (*D. S. P. Noakes, H. J. Burgess, B. E. Webb*, and *J. S. Wyatt-Smith*); The anatomical structure of wood (*P. K. B. Menon*); Identification, classification, spot characters, and uses of Malayan timbers (*P. K. B. Menon*); The seasoning of timber (*H. J. Burgess*); Defects in timber (*C. O. Flemmich, H. J. Burgess*, and *P. K. B. Menon*); Wood preservation (*H. J. Burgess*); The strength of timber (*H. J. Burgess*); Destructive agencies of timber and their defeat (*K. D. Menon, C. O. Flemmich*, and *I. P. Tamworth*); The grading and purchase of sawn timber (*C. O. Flemmich, P. A. Durgnat*, and *J. O. Egerton*) [cf. *F.A.* 21 No. 3834]; Plywood and other composite wood products (*H. J. Burgess* and *J. D. Peel*).

### 81. Wood and Bark: Structure and Properties

See also No. 2624.

### 810. General Information on Woods

See also Nos. 2818, 2820, 2824, 2975–6, 2984, 3656–7, 3896.

3638. GIORDANO, G. Le caratteristiche del legno di alcune resinose esotiche coltivate in Italia. Primo contributo: *Pseudotsuga douglasii, Pinus strobus, Pinus canariensis, Larix leptolepis.* **[Wood properties of some exotic conifers grown in Italy. Part 1. *Pseudotsuga taxifolia, Pinus strobus, P. canariensis, L. leptolepis.*]** *Contr. sci.-prat. migl. Conosc. Util. Legno, Firenze* Fasc. 3 (No. 4), 1959. pp. 44. 41 refs. [It.it.f.e.g.]

After a review of European and American literature, gives the results of studies on Italian-grown material, covering structure, and physical and mechanical properties, paying particular attention to the fibre tracheids, bcause of their importance for paper-making.

3639. BETTS, H. S. **American woods: Redwood (*Sequoia sempervirens*).** U.S. Forest Service, Washington, D.C. 1959. pp. 6. 13 refs. [Cf. *F.A.* 6 p. 166.]

3640. **A guide to South-East Asian timbers.** *Aust. Timb. J.* 25 (9), 1959 (80 . . . 85).

Reproduces in essence the information given in a guide on physical and mechanical properties and recommended structural uses, produced by Montague L. Meyer (Australia) Ltd., Adelaide and Sydney, mainly for the merchant, architect and builder.

3641. SLOOTEN, H. J. VAN DEN, and MARTINEZ E., P. Descripción y propriedades de algunas maderas venezolanas. **[Description and properties of some Venezuelan timbers.]** Instituto Forestal Latino Americano de Investigación y Capacitación, Mérida. 1959. pp. [90] + 7 + 5 tbls. + [1] + 15 dgms. 19 refs. [Span.]

Deals with 42 species, giving a short description of the tree, its common names and distribution, with data on the anatomical characteristics, mechanical and physical properties, and uses of the wood. Appendices include a table and diagrams illustrating the mechanical and physical properties of the woods, both green and dry.

3642. Ferreirinha, M. P. Madeiras do ultramar português—da colecção do Laboratório de Histologia e Tecnologia de Madeiras de Junta de Investigações do Ultramar. **[Timber from Portuguese overseas territories—from the collection of the Laboratorio de Histologia e Tecnologia de Madeiras da Junta de Investigações do Ultramar.]** *Garcia de Orta, Lisboa* 7 (2); 1959 (363–5 + 6 plates). [Port.]

[Cf. *F.A.* 18 No. 846.] *Khaya senegalensis*, *Terminalia superba*, *Pterocarpus erinaceus*, *Staudtia gabonensis*, *Oxystigma oxyphyllum* and *Gossweilerodendron balsamiferum*.

3643. **Specimen woods Nos. 289–91.** *Suppls.* to *Wood* 25 (1-3), 1960. Each pp. 2.

Mafu (*Fagaropsis angolensis*); Uganda Crabwood (*Carapa grandiflora*); and Matai (*Podocarpus spicatus*).

3644. Arkwright, P. **Know your timber: Nos. 68–70.** *Wookwkg. Ind.* 17 (1–3), 1960 (43; 97; 153). P.R.

African Ebony (*Diospyros* spp.); Balsa (*Ochroma lagopus*); and Rhodesian Teak (*Baikiaea plurijuga*).

3645. D. Drei überseeische Zitronenhölzer. **[Three overseas Lemon- or Satinwoods.]** *Holz-Zbl.* 86 (30), 1960 (455). 5 refs. [G.]

A description of Avodiré (*Turraeanthus africanus*) Citron wood (*Citrus limon*) and Amyris (*Amyris balsamifera*) including nomenclature, provenance, habit, timber properties and uses.

3646. D. Drei Mayumbe-Furnierhölzer. **[Three Mayumbe veneer timbers.]** *Holz-Zbl.* 86 (41), 1960 (620). 5 refs. [G.]

A description of Pau Rosa (*Swartzia madagascariensis*), Mutenye (*Guibourtia arnoldiana*) and Essia (*Combretodendron africanum*), discussing nomenclature (including other species with similar names), provenance (including other African regions), habit, timber properties and uses.

3647. Lamb, G. N. **Foreign woods.** *Wood, Chicago* 65 (2), 1959 (58). P.R.

Palo Cochino (*Tetragastris* sp.) and Rhodesian Copalwood (*Guibourtia coleosperma*).

3648. **Properties of Australian timbers: Rose Gum [*Eucalyptus grandis*].** *For. Prod. Newslett. C.S.I.R.O. Aust.* No. 259, 1959 (4).

Habit and distribution, timber, seasoning, uses and availability.

## 811. Structure, Identification

See also Nos. 3637, 3665–6.

3649. Bosshard, H. H. Methoden der Holzmikrotechnologie. **[Methods used in wood microtechnology.]** *Schweiz. Z. Forstw.* 111 (1), 1960 (1–11 + 3 photos, 1 gph.). 26 refs. [G.f.]

A lecture, discussing methods and equipment, for the preparation of thin sections, use of polarized and fluorescent light, of X-rays, etc., and, in more detail, the author's work on shrinkage of thin sections [cf. *F.A.* 19 No. 2284].

3650. Barskij, I. Ja., and Bardinskaja, M. S. Primenenie metoda ul′trafioletovoj fluorescentnoj mikroskopii k izučeniju lignifikacii kletočnyh stenok. **[The use of ultra-violet fluorescence microscopy in studying the lignification of cell-walls.]** *Dokl. Akad. Nauk SSSR* 129 (2), 1959 (443–6 + 1 plate). 19 refs. [Russ.] A.P.B.

Discusses the use of the method, by which (in addition to photomicrographs) energy distribution curves were obtained for the fluorescence spectra of a series of aromatic compounds (possible lignin precursors) and in the fluorescence spectra of lignified elements in carrot callus cultures and maize roots. [Cf. *F.A.* 19 No. 2244.]

3651. **The identification of timbers.** *Leafl. For. Prod. Res. Lab., Lond.* No. 34 (rev.) 1958. pp. 11. [Cf. *F.A.* 6 p. 166.]

3652. Špoljarić, Z. Drvo-anatomska građa i rastenje s ključem za makroskopsku identifikaciju. **[Wood anatomy and growth, with a lens key for identification.]** *Repr.* from *Šumarska Enciklopedija.* Leksikografski Zavod FNRJ, Zagreb. 1959. pp. 250–84 + 72 photos. 39 refs. [Croat.e.]

An article reprinted from the Jugoslav Forestry Encyclopaedia, giving an account of sub-microscopic structure, anatomical elements, structure, quality and defects of wood, and growth. A lens key is given for identifying, from cross-sections, the most important Jugoslavian woods.

3653. Eicke, R. Die Bedeutung der Feinstruktur der Hoftüpfel für die Phylogenie der Gymnospermen. **[The significance of the fine structure of bordered pits in the phylogeny of gymnosperms.]** *Zeitschrift für Botanik, Stuttgart* 46, 1958 (5–15). 33 refs. [G.g.] O.B.D.

Discusses the use of submicroscopic structure, particularly the fine structure of bordered pits, in the systematy and phylogeny of gymnosperms, and presents a brief comparative review of bordered-pit structure in the Pinaceae, Taxodiaceae, Araucariaceae and Gnetales.

3654. Kisljuk, I. M. Zametki po anatomii drevesiny araukarievyh. **[Notes on the wood anatomy of the Araucariaceae.]** *Bot. Ž.* 44 (11), 1959 (1624–31). 44 refs. [Russ.]

Notes, based on study of wood collections, young specimens of *Araucaria angustifolia*, and the literature, on bordered pits, wood parenchyma, ray tracheids, the accumulation of intercellular substances (between ray cells and tracheids), and the diagnostic value of some anatomical features. A key to the stem wood of ten species of *Agathis* is presented.

3655. Del riconoscimento del legno dei pini mediterranei. **[The identification of the wood of Mediterranean Pines.]** *Contr. sci.-prat. migl. Conosc.*

*Util. Legno, Firenze* Fasc. 2 (No. 2), 1959 (1–23). 25 refs. [It.it.f.e.g.]

In two parts: Microscopic studies (*L. Zucconi*); and Chemical and chemico-physical studies (*G. Rapi* and *E. Orlandi*). *Pinus pinaster* can be distinguished from *P. pinea* and *P. halepensis* by miscroscopic examination. The best way to distinguish between the two latter is from their extractives by a method described in the second part.

3656. JACENKO-HMELEVSKIJ, A. A., and BAJDALINA, N. A. Opredelitel′ i kratkaja harakteristika osnovnyh lesopromyšlennyh drevesin V′etnama postupajuščih na derevoobrabatyvajuščie predprijatija SSSR. **[Key and short [notes on the] characteristics of the main commercial woods of Vietnam used in the woodworking industry of the U.S.S.R.]** Leningradskaja Ordena Lenina Lesotehničeskaja Akademija imeni S.M. Kirova, Leningrad. 1959. pp. 39 + 11 photomicrographs. 21 refs. [Russ.]

Presents keys for the identification of 11 hardwood species from Vietnam and discusses the mechanical and antomical properties of 53 species in 3 groups: (i) furniture, (ii) heavy, and (iii) light building timbers. A list of references, and lists of commercial (Russian) and botanical names are included.

3657. DOLEŽAL, J. Xylotomický rozbor a technické vlastnosti některých vietnamských dřev. **[Analysis of wood anatomy and physical and mechanical properties of some Vietnam woods.]** *Drev. Výskum* 4 (2), 1959 (173–90 + 55 photomicrographs). [Cz.russ.g.e.] P.R.

Deals with the wood anatomy of *Pygeum arboreum, Canarium tonkinense, Talauma gioi, Alstonia scholaris, Mallotus cochinchinensis, Chikrassia tabularis, Cinnamomum tetragonum, Peltophorum dasyrachis, Parashorea stellata* and *Pometia pinnata*. General information is given on the native and trade names, distribution, and tree size, and for each species the physical and mechanical properties of the wood are compared with those of a better known tropical or European hardwood. Possible or actual uses for the Vietnam woods are indicated.

3658. ORTIZ CESPEDES, M. Étude anatomique de quelques-uns des principaux bois chiliens. **[An anatomical study of a few of the main Chilean woods.]** Centre Technique du Bois, Paris. 1959. pp. 25. [F.]

Briefly mentions the extent and relative importance of Chile's forest reserves compared with those of S. America as a whole, and presents short anatomical studies on the following typical native species: *Fitzroya cupressoides, Podocarpus salignus, Aextoxicon punctatum, Eucryphia cordifolia, Nothofagus dombeyi, N. obliqua, Laurelia philippiana, L. sempervirens, Guevina avellana,* and *Weinmannia trichosperma*.

3659. SUDO, S. **[Identification of Japanese hardwoods.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 118, 1959 (1–138 + 36 plates). [Jap.e.*e*.]

Illustrates and explains a card sorting key for identification of Japanese hardwoods, and lists 300 species with identifying characters and photomicrographs.

3660. KOBAYASHI, Y., and SUGAWA, T. **[Identification of wood of some *Castanopsis* species in Japan.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 118, 1959 (139–78 + 6 plates). 23 refs. [Jap.e.*e*.]

Deals with *C. cuspidata, C. thunbergii* and a natural hybrid of these two species, and illustrates them by photomicrographs.

3661. LEBEDENKO, L. A. Ontogenez drevesiny kornej i stvolov nekotoryh predstavitelej bukocvetnyh. **[The ontogeny of rootwood and stemwood in some representatives of the Fagales.]** *Dokl. Akad. Nauk SSSR* 127 (1), 1959 (213–6). 9 refs. [Russ.] A.P.B.

An account of research on (*a*) rootwood and (*b*) stemwood, from 3 specimens each of (1) *Alnus incana*, (2) *Betula verrucosa*, (3) *Corylus avellana*, (4) *Carpinus caucasica*, (5) *Fagus orientalis*, (6) *Castanea sativa* and (7) *Quercus macranthera*. In young plants, (*a*) and (*b*) were identical in (2); in (6) and (7), (*a*) lacked scalariform perforations but had much more wood parenchyma than (*b*); in (1), (3) and (4) rays were wider in (*a*) than in (*b*); in (1) and (5), (*a*) had reticulate perforations, which were absent in (*b*). In some plants, e.g. (6) and (7), the general similarity between (*a*) and (*b*) persisted for 6–7 years, while in others, e.g. (1), it persisted for only 2–3 years. Differences between (*a*) and (*b*) increased with age in all species. In the phylogenetically more advanced woods, definite mature wood formed much later than in the less advanced woods, e.g. in the 8–10th annual ring in (7), in the 12–14th in (6), and the 3–4th in (1) and (2).

3662. BRAZIER, J. D. ***Pseudosindora palustris* Sym., an account of its timber and anatomical evidence for its taxonomic status.** *Proc. Linn. Soc. Lond.* 170 (2), 1959 (178–83 + 1 plate). 12 refs.

Presents data on the characteristics of the wood and its structure. A comparative anatomical study supports the evidence for maintaining *Pseudosindora* as a separate genus. It differs in a number of respects from the Asian species of *Sindora*, notably in the absence of axial intercellular canals. The same characteristic also distinguishes *Pseudosindora* from *Copaifera* (*s.s.*) and *Sindoropsis*. *Pseudosindora* also differs in wood structure from *Guibourtia*. A table is included of anatomical and physical features of diagnostic value for distinguishing *Pseudosindora, Sindora, Copaifera* and *Guibourtia*.

3663. FAHN, A. **Xylem structure and annual rhythm of development in trees and shrubs of the desert. III. *Eucalyptus camaldulensis* [*E. rostrata*] and *Acacia cyanophylla*.** *Bull. Res. Coun. Israel* 7 *D* (3/4), 1959 (122–30). 12 refs.

[Cf. *F.A.* 20 No. 5091.] The wood structure, the annual developmental rhythm, and the seasonal changes in starch content of *E. rostrata* and *A. cyanophylla* grown in Israel are described. In *E. rostrata*, development of growth rings commences in (August-) September, which corresponds to the spring in Australia, where this species occurs naturally. In the wood the vessels are generally solitary and have spiral thickenings on inner walls as well as vestured pits. Vasicentric tracheids and fibre tracheids occur, but no libriform tracheids were observed. In *A. cyanophylla*, no growth rings were found, and the cambium is active throughout the year, reaching a peak during February–May. The vessels are prevailingly arranged in multiples of 2–4, irregular clusters and solitary vessels are also common. The pits are vestured. In both species examined, no correlation was found between the changes in starch content of the xylem and the intensity of cambial activity. *From author's summary.*

### 811.1. Anatomical Elements and Tissues

See also Nos. 3071, 3650, 3683–4, 3693, 3705, 3724, 3795, 3806, 3835, 3840–1.

3664. BESLEY, L. **Relationships between wood fibre properties and paper quality.** *Woodl. Res. Index Pulp Pap. Res. Inst. Can.* No. 114, 1959. pp. 19. 46 refs.

A review of literature, mainly N. American.

3665. LADELL, J. L. **A method of measuring the amount and distribution of cell wall material in transverse microscope sections of wood [*Pinus strobus*].** *J. Inst. Wood Sci.* No. 3, 1959 (43–6). 1 ref.

Point samples are taken at random on a transverse section (t.s.) and recorded as falling on cell-wall or on lumen. The proportion of points falling on cell-walls gives the % of cell-wall material in the area sampled. In practice, the samples are taken by projecting the image of the t.s. on a card (the sampling field), which is pierced by 100 small pinholes distributed at random. These, when illuminated from below, give 100 clearly visible sampling points on the projected image. The method is fast, easy to use, and probably more accurate than direct measurement. The diameters and cross-sectional areas of cells can easily be obtained at the same time. *From author's summary.*

3666. LADELL, J. L. **A new method of measuring tracheid length.** *Forestry* 32 (2), 1959 (124–5).

The image of a tangential microscope section is projected on to a surface on which two parallel lines are drawn at a known distance apart and ⊥ to the long axis of the tracheids. The number of cell tips occurring between the lines in a predetermined number of contiguous cells is counted. Values are then substituted in the following relationship:

$$\text{Mean tracheid length} = \frac{\text{Number of contiguous cells} \times \text{distance between lines}}{\text{number of cell tips.}}$$

The method is faster than the usual maceration technique, but its greatest advantage is the accuracy with which samples can be located. *From author's summary.*

3667. LIESE, W., and DADSWELL, H. E. Über den Einfluss der Himmelsrichtung auf die Länge von Holzfasern und Tracheiden. [**The influence of the cardinal points on the lengths of wood fibres and tracheids.**] *Holz Roh- u. Werkstoff* 17 (11), 1959 (421–7). 26 refs. [G.g.e.] P.R.

The influence of solar radiation on the lengths of fibres and tracheids taken from different parts (N. and S. sides) of various growth rings was investigated in *Populus × robusta*, *Pseudotsuga taxifolia*, *Dendrocalamus strictus*, *Albizzia falcata*, *Khaya anthotheca*, *Eucalyptus regnans*, *E. gigantea*, *Pinus radiata* and *P. pinaster*. The material was collected from various latitudes on both sides of the equator, from trees almost fully exposed or only slightly shielded by surrounding trees. In all specimens, fibres were shorter on the 'sun side' than on the 'shaded side' of the tree, the differences ranging from 0·05 mm. in *Populus × robusta* to 0·35 mm. in *Pinus radiata* and *P. pinaster*. Within any one growth ring, there was more difference in the late wood than in the early wood. It would thus appear possible to orient a disk cut from a stem, by using results of fibre length determinations from one ring. Basic density and tensile strength are only slightly influenced by these differences in fibre length. The significance of these results is discussed in relation to the physiology of growth and related matters.

3668. DAVID, R., LAPRAZ, G., and BOST, J. Influence de l'âge du cambium sur la longueur des trachéides chez le pin maritime. [**Influence of cambium age on tracheid length of *Pinus pinaster*.**] *C.R. Soc. Biol., Paris* 153 (10), 1959 (1960), (1560–2). 2 refs. [F.f.] O.R.S.

Measurements were made on a Pine ca. 100 years old, tapped for the last 48 years and with a wound at its base inflicted 80 years before felling. Samples were taken there and at every 2·10 m. up to the top. Above 2·10 m. from the ground, tracheids increased in length with increasing age of the cambium. In the butt, the same was true for the first 29 years, but for the next 75 years, length decreased. At 2·10 m., length increased for 24 years, decreased for 12, increased for 24 and decreased for 36 years. It is concluded that cambial cells normally lengthen with increasing cambium age, but that wounding (accidental or by tapping) causes a rejuvenation of the cambium and a decrease in cell length.

3669. Dell' influenza della resinazione sopra le caratteristiche del legno di alcuni pini. [**The effect of resin-tapping on the properties of the wood of several Pines.**] *Contr. sci.-prat. migl. Conosc. Util. Legno, Firenze* Fasc. 2 (No. 3), 1959 (25–76). 9 refs. [It.it.f.e.g.]

Includes four separate articles: (1) Macroscopic and mechanical studies on the wood of various Pines (*G. Giordano*). Several thousand test pieces were taken from 19 tapped and 19 untapped trees (8 *Pinus pinea*, 3 *P. pinaster*, 1 *P. halepensis*, 2 *P. sylvestris*, and 5 *P. nigra*), from which the following conclusions are drawn: Tapping caused a slight increase in sp. gr. only in *P. nigra*; bending and compressive strength were slightly reduced in *P. sylvestris*, but not significantly or consistently affected in the other species; impact strength appeared to be slightly reduced in *P. pinea* and *P. nigra* and slightly increased in *P. sylvestris* and *P. halepensis*; for all species deflection was unaffected and there appeared to be no change in resistance to insects or fungi. (2) Microscopic study of the wood structure of *P. sylvestris* with particular reference to the resin canals and medullary rays (*L. Moggi-Demi*). Samples were taken from 2 tapped and 2 untapped trees from the same even-aged stand (ca. 25 years old). No consistent differences were found in the numbers or dimensions of resin canals and medullary rays. (3) Microscopic study of the wood structure of *P. nigra* with particular reference to the resin canals (*R. Quattrocchi Rosso*). Samples were taken from 2 tapped and 2 untapped trees from the same even-aged stand (ca. 65 years old). No consistent differences were found in the numbers or dimensions of the resin canals. (4) Microscopic study of the wood structure of *P. nigra* with particular reference to the fibre tracheids. Samples were taken of early, late, and intermediate wood from the 7th, 30th and 65th growth rings of a tapped tree and from the 8th, 35th and 75th of an untapped one, tracheid length and the fibrillar angle were measured in all samples, but no difference was found between the tapped and untapped trees.

3670. KRASNITSKIJ, A. M. Mikroskopičeskoe stroenie drevesiny jasenja obyknovennogo iz različnyh uslovij proizrastanija. **[The microscopic structure of the wood of *Fraxinus excelsior* growing under various conditions.]** *Dokl. Akad. Nauk SSSR* 126 (4), 1959 (884–5). 16 refs. [Russ.] A.P.B.

[Cf. *F.A.* 20 No. 5092.] The material examined consisted of 52 annual rings (1886, 1906, 1926, 1946), taken at b.h., of Ash trees growing in Oak forests (1) on dark-grey clay-loams, (2) on solonetz-type clay-loams, (3) of the flood-plain type, and (4) on chalk. Measurements were of 14 different anatomical characteristics (results tabulated). On the basis of the differences found, it is concluded that Ash has three ecological forms; (*a*) on (1) and (2); (*b*) on (3); and (*c*) on (4). Certain of the anatomical characters examined did not vary in this manner, e.g. late-wood %, early-wood vessel diameter, volume of parenchyma, and porosity due to vessels.

3671. HO, T.-H. **[Growth rings of *Eucalyptus robusta* Sm. The influence of temperature and rainfall in Canton on the woody elements.]** *Acta bot. sinica* 8 (4), 1959 (247–58). 37 refs. [Chin.e.]

Wood samples taken at b.h. from trees in Canton were examined, and the climate of Canton was compared with that of New South Wales. Examination of the anatomical elements in different parts of the same growth ring revealed an unusual seasonal growth layer, in which the elements differed in size and number from those in the rest of the ring. It is thought that this unusual layer may correspond to the early wood formed in N.S.W.

### 811.2. Special Features and Abnormal Structure

See also Nos. 3669, 3826.

3672. SACRÉ, E. Le bois de tension des peupliers. **[Tension wood in Poplars.]** *Bull. Inst. Agron. Gembloux* 27 (4), 1959 (435–44). 10 refs. [F.] E.M.B.

The mechanical and physical properties of tension wood (t.w.) were studied in 36 Poplar specimens. Values for density and for shrinkage (volumetric, radial, and tangential) are higher than for normal wood. It is slightly harder, and resistance to shock is ca. 40% greater, but values for resistance to axial compression, bending, and splitting, and for tensile strength ⊥ and longitudinal shear strength are much the same as in normal wood. A study of 26 samples taken at ca. 5 m. height from stems of 26 Poplars of different cultivars (*Populus* × *robusta*, *P.* × *serotina*, *P.* × *regenerata* and *P.* × *marilandica*) showed the mean % of t.w. to be highest in *P.* × *robusta* and lowest in *P.* × *regenerata*. Samples from 19 Poplars growing in closed stands showed that the orientation of t.w. zones was not constant in trees growing under the same conditions. In excentric stems, t.w. was present in the broader as well as in the narrower part of the growth ring. In an examination of 8 Poplar logs, the highest % of t.w. (i.e. 70% of the whole) was found at the base. In specimens from bent parts of the stem the average % of t.w. was 32 and in those from straight parts of the stem 23. The average % of t.w. in excentric sections was 42, and in concentric sections 22% of the entire section. Disadvantages and possible causes of t.w. formation are discussed. Stands should be spaced to give even and straight growth, pruning should be moderate, and cultivars known to produce a low % of t.w. should be chosen.

### 811.4. Growth Rings. Early and Late Wood

See also Nos. 3571, 3667, 3670–1, 3721–2, 3728, 3753.

3673. ERICSON, B. **Latewood percentage, density and volumetric shrinkage in wood of *Picea abies* (L.) Karst. f. *virgata* Jacq. A comparison with *Picea abies*.** *Rapp. Avd. Skogsprod. Skogsforskn-Inst., Stockh.* No. 2, 1960. pp. 15. 20 refs. [E.e.]

An analysis of increment cores from 22 Norway Spruce with a virgate branching habit showed late-wood %s varying roughly from 11 to 6, against 8 to 4·5 in normally branching controls. For rings of equal width it was ca. 2% higher in virgate forms. Density was also slightly greater, but not shrinkage values, and anatomical structure was normal. The higher late-wood % of the virgate forms may be connected with a wider spacing in the stand.

### 811.5. Sapwood and Heartwood

See Nos. 3714, 3753.

### 811.6. Texture, Grain, Figure

See also No. 3828.

3674. OHKURA, S. **[On the macroscopic features of twisted fibre in trees.]** *Journal of the Faculty of Agriculture, Shinshu University, Nagano* No. 8, 1958 (59–100). 54 refs. [Jap.e.e.] C.G.B.

Discusses the features of spiral grain, describing a splitting technique for determining its angles and patterns (including changes of direction) from sections of bolts, and a system of classification of these patterns. Lists of ca. 50 conifers and 140 hardwoods, many of them Japanese, with their spiralling tendencies, are presented. Though patterns were usually characteristic of a species, they appeared not to be related to taxonomy, one genus often containing both left-hand and right-hand species. The latter appeared to be more numerous in the southern hemisphere.

### 812. Physical and Mechanical Properties

See also Nos. 3672, 3720–9, 3753.

3675. Sekhar, A. C., and Rana, R. S. **Physical and mechanical properties of woods tested at the Forest Research Institute, Dehra Dun. Report IX.** *Indian For. Rec.* (*n.s.*) *Timb. Mech.* 1 (10), 1957 (1959), (163–5 + 1 tbl.).

[Cf. *F.A.* 21 Nos. 2298–2300.] Gives tabulated data on *Tectona grandis*, *Mesua* sp., *Morus alba*, *Pinus radiata*, *Shorea robusta*, *Terminalia tomentosa*, and *Ailanthus grandis*.

3676. Benson, H. P. **Some physical properties of Gulf Black Willow** [*Salix nigra*]. *Sth. Lumberm.* 199 (2489), 1959 (139–40).

Presents data on sp. gr., moisture content, sapwood % and shrinkage values, and their distribution in the tree based on an analysis of 10 stems from two areas in S.W. Mississippi.

### 812.1. Optical, Acoustic, Frictional, Thermal and Electrical Properties

See also Nos. 3687–9, 3786–7.

3677. Nambiyar, V. P. N. **Investigations on the Russel effect in woods.** *For. Prod. J.* 10 (1), 1960 (48–50). 11 refs.

A preliminary report on tests carried out at Pennsylvania State University, including various American species, and indicating that the effect is a purely chemical phenomenon, caused by volatile substances, and in no way connected with light or other radiation. [Cf. *F.A.* 17 No. 1947.]

3678. Jentzsch, H. Die Zünd- und Brenneigenschaften des Holzes und ihre Prüfung. **[Ignition and burning properties of wood, and methods of testing them.]** *Mitt. BundesforschAnst. Forst- u. Holzw.* No. 44, 1959. pp. iv + 56. 70 refs. [G.]

Reviews German and foreign testing apparatus, discusses relevant concepts of ignition and combustion etc., and some data on thermal properties, inflammability, etc., of various woods, behaviour of wood in actual fires, dust explosions, etc. [Cf. *F.A.* 20 No. 3683.]

### 812.2. Behaviour with Liquids and Gases. Moisture Relations etc.

See also Nos. 3649, 3673, 3690, 3744, 3790–1, 3806–7.

3679. Bali, B. I., and Rehman, M. A. **Calibration of moisture meters for veneers. Part I.** *Indian For. Leafl.* (*n.s.*) No. 162, 1959. pp. 7.

Gives the calibration figures for veneers of 18 species of Indian timbers, for use with two types of moisture meter.

3680. Bois, P. J. **Wood moisture content in homes. Seasonal variations in the Southeast.** *For. Prod. J.* 9 (11), 1959 (427–30). 1 ref.

Presents data from a study in which the m.c. of Basswood [*Tilia* spp.] specimens distributed in houses from Virginia to Georgia was recorded weekly over a year. The values varied from 5 to 19%. Piedmont houses showed higher m.c.'s and greater variations as between seasons and parts of a house than mountain houses. [Cf. *F.A.* 17 No. 4403.]

3681. Smith, H. H., Ellwood, E. L., and Erickson, R. W. **Survey of the moisture content of wood in use in California.** *Calif. For. & For. Prod. Calif. For Prod. Lab.* No. 16, 1959. pp. 3 + 3 tbls., 4 dgms., 1 gph.

Presents data, from weekly (indoor and outdoor) determinations for ca. 18 months at 23 largely representative stations from commercial 1 × 6-in. boards of 3 hardwood and 4 coniferous species, showing seasonal and annual m.c.'s for composite samples of the 7 species and derived isopleths; also mean monthly m.c. fluctuations for each species. [Cf. *F.A.* 9 No. 2434.]

3682. Drahoš, V. Sesychání našich jehličnatých dřevin a stanovení přídavků na sesychání. **[The shrinkage of Czechoslovakian softwoods and the determination of shrinkage tolerances.]** *Drev. Výskum* 4 (1), 1959 (71–86). 5 refs. [Cz.cz.russ.g.e.] P.R.

Experiments done in connexion with the revision of Czechoslovakian Standard ČSN 49 1109. Comparisons were made of the shrinkage of kiln- and air-dried Spruce and Pine, and of differences between heartwood and sapwood shrinkage. The influence of the direction of the annual rings on shrinkage was also investigated. Shrinkage tolerances were determined statistically, and the results are shown in graphs.

3683. Nečesaný, V. Objemove změny bukového dřeva. I. Vliv základních fysikálních vlastností na nasycení blan a objemové nabotnání dřeva. **[Volume changes in Beech. I. Influence of physical properties on cell-wall saturation and on the amount of swelling of the wood.]** *Drev. Výskum* 4 (1), 1959 (13–26). 14 refs. [Cz.cz.russ.g.e.] P.R.

Graphs and tabulates the influence of wood density, cell-wall density, and the cell-wall/wood-volume ratio, on cell-wall saturation and the swelling of Beech.

3684. Nečesaný, V., and Morárová, E. Objemové zmeny bukového dreva. II. Vplyv obsahu celulózy na nasýtenie blán a objemové napučanie dreva. **[Volume changes in Beech. II. Influence of cellulose content on cell-wall saturation and on the amount of swelling of the wood.]** *Drev. Výskum* 4 (1), 1959 (27–38). 19 refs. [Slovak.slovak.russ.g.e.] P.R.

In continued work [see preceding abstract] a direct significant relationship was found between the cellulose content and cell-wall saturation, wood density, the volume ratio of cell-walls in the wood, and the capacity of cell-wall density and volume to change over the range from 0% m.c. to cell-wall saturation. It is deduced that lignin probably limits the swelling of wood to a greater extent than cell-wall saturation. Further investigation is required to prove the validity of this deduction.

3685. HORIIKE, K., and KATO, S. **[The heat of wetting of wood. I. Hydrogen bonding and swelling of wood.]** *J. Jap. Wood Res. Soc.* 5 (5), 1959 (181–5). 14 refs. [Jap.e.*e.*] P.R.

Tabulates the mean values for the heats of wetting for *Picea jezoensis* with water and 16 chemical solvents. A correlation is suggested between the degree of swelling and heat of wetting, and the swelling behaviour of the wood is explained on the hypothesis that its magnitude is directly related to the intensity of H bonding between the constituents of wood and the swelling agent.

3686. BURO, A., and BURO, E.-A. Untersuchungen über die Durchlässigkeit von Kiefernholz. **[Investigations on the permeability [to air] of Pine wood.]** *Holz Roh- u. Werkstoff* 17 (12), 1959 (461–74). 22 refs. [G.g.e.] P.R.

Describes a special apparatus developed for measuring the flow of compressed air through wood, and discusses flow laws, the relation of gas pressure, sample length, and m.c. to flow, calculation of the number of pores and total pore area, etc. Tests on 7-mm. Pine cubes showed that in most cases permeability (*p*) decreased from the outer to the inner sapwood. No clearly defined zone of lower *p* near the heartwood boundary could be observed; *p* seemed to decrease up the tree, and the wider the sapwood, the greater its *p*. Variation in annual-ring width seemed to have little influence on *p*. No constant relationship was found as between the three principal axes, but the ratios *p* axial/*p* radial, and *p* tangential/*p* radial increased with decreasing radial *p*. There was no definite superiority in *p* for either early or late wood. Swedish Pine had lower radial *p* than German Pine of the same sapwood thickness. The influence of extraction on the increase of *p* was greater with samples of originally poor *p* than with those of originally high *p*. Some tests were also made to compare the experimental advantages of cubes and cylindrical samples. The difficulty of calculating the flow of liquids through wood using the *p* values for gases is also discussed.

### 812.3. Density. Specific Gravity. Buoyancy

See Nos. 2752, 2757, 3669, 3673, 3683–4, 3720, 3724–9, 3744, 3790, 3841.

### 812.7. Strength Properties

See also Nos. 3364, 3637, 3669, 3722, 3724, 3737, 3753–4, 3789, 3791, 3826.

3687. JAYNE, B. A. **Indices of quality. Vibrational properties of wood.** *For. Prod. J.* 9 (11), 1959 (413–6). 5 refs.

Clear, straight-grained Sitka Spruce specimens measuring 0·6 × 0·8 × 15 in., with 8–30 growth rings/in., were tested by electronic equipment for inducing and recording vibratory motion generated by an audio-signal. The dynamic modulus of elasticity computed from dimensions, weight and fundamental resonant frequency was closely correlated with the static modulus of elasticity, and enabled the modulus of rupture to be estimated to a 95% confidence limit of 1000 lb./sq. in. By using the ratio of the dynamic modulus of elasticity to the logarithmic decrement (an expression of the dynamic energy-loss determining the dying away of vibrations) the confidence limit was narrowed to ± 900 lb. Similarly the proportional-limit stress could be estimated to a confidence limit of ca. ± 1000 lb. by reference to the ratio of the sp. gr. to logarithmic decrement. The prospects of more accurate grading and reduction of unnecessarily wide safety margins by individual non-destructive testing of this kind are considered promising.

3688. MATSUMOTO, T. **[Studies on the dynamic modulus E of wood by transverse vibration. 2. The relationship of the dynamic modulus to moisture content and of the dynamic modulus to the static modulus.]** *J. Fac. Agric. Iwate Univ.* 4 (1), 1958 (73–8). 7 refs. [Jap.e.*e.*] O.R.E.

The modulus of elasticity, measured by the dynamic method, was 5–10% higher than that measured by the static method. With a decrease of 1% in wood m.c., the dynamic modulus increased, in Japanese Larch by 1·1%.

3689. MATSUMOTO, T. **[Studies on the dynamic modulus E of wood by transverse vibration. 4. The relationship of the dynamic modulus to grain (fiber) angle.]** *J. Fac. Agric. Iwate Univ.* 4 (3), 1959 (253–8). 11 refs. [Jap.e.*e.*] O.R.E.

3690. ARMSTRONG, L. D., and KINGSTON, R. S. T. **Effect of moisture changes on creep in wood.** *Nature, Lond.* 185 (4716), 1960 (862–3).

In tests on *Eucalyptus regnans* (a hardwood apt to collapse during seasoning), *E. pilularis* (one with very little tendency to collapse), and *Pinus radiata* (a softwood with negligible tendency to collapse), it was shown that the relative creep in wood allowed to dry while under load was at least twice that occurring in wood under load and maintained at constant m.c., irrespective of whether it was green or dry. Similar results were obtained for all three species. Exploratory experiments have indicated that creep also increases markedly in wood subjected to increasing m.c. during test. In green wood drying while under load, a marked difference in total creep and creep-rate has been observed for geometrically similar beams of different sizes.

3691. SAWADA, . M **[Studies on the mechanical characteristics of woods, mainly as affecting factors of wood beams.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 108, 1958 (115–224 + 8 plates). 128 refs. [Jap.e.*e.*]

A study was made of the behaviour under normal stresses (compression or tension) of 10 softwoods and 27 hardwoods, the factors investigated being stress/strain curves, elastic constants, stresses at proportional limit, compressive strength, shear strength, tensile strength in 6 directions (along the 3 principal axes and at 45° in their planes), and various types of failure under normal and shearing stresses. The following are some of the results of the study: (1) Compressive or tensile failure occurs when the stress reaches maximum specific strain $\epsilon_o$ ($\sigma_m/E$ where $\sigma_m$ = strength and $E$ = Young's modulus). (2) Most timbers have, generally, a linear range in the stress/strain curves, and Young's modulus is the same in compression as in tension. (3) A considerable difference was observed between softwoods and hardwoods in the tensile-strength tests in the 6 directions; e.g. in hardwoods the value of $\epsilon_o$ tended to be the same in all directions, whereas in softwoods it was 7–8 times as great at 45° in the transverse plane as in the tangential direction. (4) The softwoods were in general more anisotropic than the hardwoods except Apitong [*Dipterocarpus* spp.] which was the most anisotropic of all the test materials. From the results obtained, methods of computing strength of beams from theoretical equations are derived.

3692. Giordano, G., and Currò, P. La variation de la résistance au cisaillement en fonction de la température. **[The effect of temperature on shear strength [of Poplar wood].]** [*Docum.*] *Int. Poplar Comm., 6th Sess. Wkg. Party on Exploitation and Utilization, Rome 1959* No. *FAO/CIP/UT/9B*, 1959. pp. 5. [F.]

Experiments, designed to elucidate grinding properties, were made on saturated samples (m.c. nearly 200%) cut from two stems of Clone I 214 Casale Monferrato. Breaking loads in shear fell from 18·04 kg./sq. cm. at 30° C. to 14·16 at 60° and 8·61 at 90°.

3693. Ahlborn, M. Beiträge zur Kenntnis der Festigkeitsausbilding der Festigungsgewebes einheimischer Laubhölzer und des Einflusses der Länge der Sklerenchymfasern auf die Ausbildung der Zugfestigkeit. **[The strength of the mechanical tissue of German hardwoods, and the effect of the length of sclerenchyma fibres on tensile strength.]** Thesis, Technische Hochschule, Braunschweig. [1957?] pp. 85. 87 refs. [G.g.] P.R.

Describes tests on models composed of strips of veneer and cardboard, to determine the relations between fibre length, fibre overlap and tensile strength ∥. These confirmed theoretical assumptions, based on the laws of mechanics, that increasing strength predicates increasing the fibre length and overlap so as to ensure optimum utilization of cell-wall material (strength/density ratio) by a corresponding increase in the strength of the connexion between fibres. Detailed investigations comparing wood from the 1st and 4th rings of a young *Populus* × *robusta*, from successive zones in one growth ring, and from different individuals, largely confirmed that with increasing strength and density, not only cell-wall thickness, but fibre length and overlap, increased; fibre diameter decreased slightly. In Beech a lengthening of fibres occurred with increasing strength and density, as between a narrow and a wide annual ring but, presumably because of the development of corrugations in the overlapping ends of fibres (which modified the mechanical principles involved), there was no increase in overlap. No clear results emerged from experiments to discover the strength of the connective tissues of Beech, Birch and Poplar by tests in tension ⊥ on green wood, but tests after chemical treatment to weaken the middle layer of the secondary wall suggest that the connective tissue probably varies in strength from species to species.

### 812.8. Workability. Working Properties

See No. 3729.

## 813. Wood Chemistry

See also Nos. 2624, 2640, 2709, 3840–1.

### 813.1. Chief Organic Constituents. Constituents of the Cell Wall

See also Nos. 3650, 3684–5, 3791, 3794, 3856.

3694. Kürschner, K., and Karácsonyi, Š. Najnovší stav kvantitatívneho určenia lignínu. **[The present position regarding the quantitative determination of lignin.]** *Drev. Výskum* 4 (1), 1959 (3–12). 26 refs. [Slovak.russ.g.e.] P.R.

Reviews some of the literature, and describes a method whereby lignin is transformed by nitration into soluble nitrolignin, which is quantitatively removed by extraction with *n*-butanol. Lignin contents determined for Czechoslovakian tree species by this method are ca. 10% lower than values given in world literature. This disparity is discussed briefly.

3695. Nishio, K. **Investigation with the Mäule reaction on plant tissues. I.** *Bot. Mag., Tokyo* 72 (856), 1959 (384–7). 7 refs. [E.e.jap.] I.M.I.

The Mäule test was applied to plants likely to be intermediate between the coniferyl and the syringyl types in lignification. Tissues of such plants often showed various grades in colour, from red to yellow in the same plant. In *Podocarpus macrophyllus* this occurred in the xylem, showing stripes of red and yellow. In *Illicium anisatum* both positive and negative colours with the Mäule reaction were seen in the same cell, as well as in the same tissue. *From author's summary.*

3696. Ekman, K. H., and Lindberg, J. J. **On the origin of the infra-red bands in the 1720 cm$^{-1}$ region in lignins.** *Pap. ja Puu* 42 (1), 1960 (21–2). 9 refs. [E.e.] P.R.

The absorption bands of some lignin preparations in the $5{\cdot}8\mu$ region have been investigated. They are interpreted as caused by carboxyl groups imbedded in a strong polar medium. The position of the carboxyl groups in the lignin structure is discussed. *Authors' summary.*

3697. Adler, E., Delin, S., and Lundquist, K. **Phenylcoumaran elements in Spruce lignin.** *Acta chem. scand.* 13 (10), 1959 (2149–50). 7 refs. [E.] O.R.S.

Discusses the demonstration by spectrophotometric analysis of the formation of phenylcoumarone systems from phenylcoumaran elements on treatment of Björkman lignin with hot acid, and the estimation of the frequency of phenylcoumaran elements in the lignin.

3698. Reznik, H. Beiträge zur Physiologie der Verholzung. **[The physiology of lignification.]** *Planta* 54 (4), 1960 (333–64). 52 refs. [G.g.] O.B.D.

$C^{14}$-labelled phenylpropane and vanillin derivatives were applied to leaves of 2- and 3-year-old *Picea abies* and *Castanea sativa*, and microphotographic records were made of the incorporation of various compounds into the cell membranes of the shoot-axis tissue [cf. *F.A.* 17 No. 825; 28 No. 1325]. In *P. abies* the following compounds were incorporated into the portion of the cell-wall of the secondary xylem corresponding to the lignin fraction: phenylalanine, phenylalanine plus methionine, *p*-coumaric acid, ferulic acid, *d*-coniferin, and *d*-coniferin plus methionine. In *C. sativa* the following were incorporated: *p*-coumaric acid, *d*-coniferin and *d*-syringin. No incorporation into the cell-wall in *P. abies* took place after the introduction of the following: gluco-*p*-coumaric acid, gluco-ferulic acid, coniferin, *d*-syringin and *l*-gluco-vanillin. The suitability of this method for studies of lignin biosynthesis is discussed, and the positive and negative results are interpreted within the general framework of phenylpropane metabolism.

3699. Acerbo, S. N., Schubert, W. J., and Nord, F. F. **Investigations on lignin and lignification. XXII. The conversion of *d*-glucose into lignin in Norway Spruce.** *J. Amer. Chem. Soc.* 82 (3), 1960 (735–9). 28 refs. O.R.S.

[Cf. *F.A.* 21 No. 978.] *d*-Glucose labelled with $C^{14}$ and fed to Norway Spruce through the needles was appreciably incorporated into the lignin. The activities of the materials and compounds obtained by degradation of the lignin are shown in a table.

3700. Kratzl, K., and Buchtela, K. Zur Biogenese des Angiospermenlignins. **[The biogenesis of angiosperm lignin.]** *Monatshefte für Chemie, Wien* 90 (1), 1959 (1–6). 9 refs. [G.g.] P.O.

Ethanolysis by a simple method suggested that the syringyl structural unit in angiosperm lignin is of the β-aryl ether type.

3701. Mosheiko [Možejko], L. N., and Ssergejewa, W. N. [Sergeeva, V. N.]. **[Changes in the nature of the lignin in wood of fast-growing Poplar under the influence of growth conditions.]** *Latvijas PSR Zinātņu Akadēmijas Vēstis, Riga* 1958 (4), (57–69). [Russ.?] From *abstr.* in *Holzforschung, Berlin* 13 (5), 1959 (157). [G.] P.R.

Analyses of lignin preparations from fast-growing *Populus trichocarpa* showed that compounds of an aromatic nature were formed in young shoots at the beginning of the growing season (June), in considerable quantities—more than half the amount found in the mature wood, but containing fewer methoxyl groups. Under short-day conditions, a greater quantity of easily soluble lignin fractions is present.

3702. Kennedy, R. W., and Jaworsky, J. M. **Variation in cellulose content of Douglas Fir.** *Tappi* 43 (1), 1960 (25–7). 6 refs. P.R.

Briefly discusses the desirability of propagating trees with high cellulose content, and tabulates data from analyses made on 8 Douglas Fir for cellulose yields and corresponding carbohydrate and α-cellulose values. Site, crown class, radial position, growth rate, and % summerwood failed to account for the variation observed in cellulose content, the difference between trees being ascribed to variability that is probably genetically controlled.

3703. Bayley, C. H., and Rose, G. R. F. **Metal-organic complexes formed during the treatment of wood with metal salts.** *Nature, Lond.* 185 (4709), 1960 (313–4). 9 refs.

Controverts the opinion of Belford *et al.* that metal-cellulose complexes are formed during the treatment of wood with inorganic salts [cf. *F.A.* 19 No. 4907]. In the opinion of the present authors, the complexes so formed consist of metal cations bound on the acidic groups of non-cellulosic constituents of the wood.

3704. Belford, D. S., and Preston, R. D. **Copper-cellulose complexes.** *Nature, Lond.* 185 (4717), 1960 (911). 7 refs.

Replies to the criticisms of Bayley and Rose [see preceding abstract].

3705. Meier, H., and Wilkie, K. C. B. **The distribution of polysaccharides in the cell-wall of tracheids of Pine (*Pinus sylvestris* L.).** *Holzforschung, Berlin* 13 (6), 1959 (177–82). 19 refs. [E.e.g.] P.R.

Pine tracheids in different stages of maturation were isolated by micromanipulation, the tracheid fractions hydrolysed, and the sugars quantitatively determined after separation by paper chromatography. The youngest tracheids, possessing only a middle lamella and a primary wall, were found to consist principally of pectic substances. Older tracheids had also a transition layer and a smaller proportion of pectic substances but higher %s of cellulose, glucomannan and glucuronoaraboxylan. Still older tracheids had a secondary wall and were richer in glucomannan and poorer in glucuronoaraboxylan. Fully developed tracheids also had a tertiary wall (or inner layer of the secondary wall) and were particularly rich in glucomannan. This distribution of polysaccharides in the tracheid cell-wall is supported by analyses of spring- and summerwood. *From authors' summary.*

3706. Adams, G. A. **Structure of an arabogalactan from Tamarack (*Larix laricina*).** *Canad. J. Chem.* 32 (2), 1960 (280–93). 32 refs. O.R.S.

3707. Hamilton, J. K., Partlow, E. V., and Thompson, N. S. **The nature of a galactoglucomannan associated with wood cellulose from Southern Pine.** *J. Amer. Chem. Soc.* 82 (2), 1960 (451–7). 31 refs. O.R.S.

A mixture of galactoglucomannans and araboxylans was extracted with 5% Na hydroxide from wood cellulose produced from a combination of *Pinus elliottii* and *P. palustris*. The structure of an acetone-soluble galactoglucomannan acetate separated from the mixture is discussed.

### 813.2. Minor Organic Constituents. Extractives. Cell Contents

See also Nos. 3206, 3655, 3677.

3708. Nair, G. V., and Rudloff, E. von. **The chemical composition of heartwood extractives of *Larix lyallii* Parl.** *Canad. J. Chem.* 32 (2), 1960 (177–81). 15 refs. O.R.S.

The heartwood contained 4·8% acetone-soluble material, yielding taxifolin (26%), aromadendrin (17%), conidendrin (0·03%), β-sitosterol, nonan-2-ol, phthalic acid, and a mixture of fatty acids.

3709. Freudenberg, K., and Weinges, K. Lignane des Lärchen- und Erlenholzes (*Larix decidua* und *Alnus glutinosa*). **[Lignans from Larch and Alder wood.]** *Tetrahedron Letters, London* 1959 (17), (19–22). [G.] O.R.S.

3710. Briggs, L. H., Cambie, R. C., and Hoare, J. L. **Chemistry of the Podocarpaceae. III. A new lignan, seco-isolariciresinol and further constituents of the heartwood of *Podocarpus spicatus*.** *Tetrahedron, Lond.* 7 (3/4), 1959 (262–9). 30 refs. [E.e.] O.R.S.

[Cf. *F.A.* 21 No. 994.] The structure of the lignan was determined. The minor constituents (+)-taxifolin, (+)-aromadendrin, kaempferol, and sequoyitol, as well as the compounds previously reported, (matairesinol, α-conidendrin, quercetin, genistein and podospicatin) were isolated from the heartwood extractives.

3711. Briggs, L. H., *et al.* **Chemistry of the Podocarpaceae. IV. Constituents of the heartwood of *Podocarpus dacrydioides* A. Rich.** *Tetrahedron, Lond.* 7 (3/4), 1959 (270–6). 18 refs. [E.e.] O.R.S.

[Cf. *F.A.* 21 No. 993.] The extractives contain the known diterpenoid constituents podocarpic acid, methyl podocarpate, ferruginol, $\Delta^9$-dehydro-ferruginol, sugiol, a trace of xanthoperol and a new resin acid, $C_{20}H_{28}O_5$, for which the name podo-dacric acid is proposed. A saturated hydrocarbon is probably *n*-heptacosane. *From authors' summary.*

3712. Takahashi, T. **[On the wood constituents of *Podocarpus macrophyllus* D. Don. I. Occurrence of a phenolic acid. (1).]** *J. Jap. Wood Res. Soc.* 5 (5), 1959 (185–8). 10 refs. [Jap.e.*e.*] P.R.

The molecular formula of one of the two crystalline substances isolated from the wood of *P. macrophyllus* agrees with $C_{20}H_{28}O_3$, with one carboxyl and one phenolic hydroxyl group. Methyl and acetyl derivatives of the compound were prepared, and ultra-violet and infra-red absorption spectra of the compound and its derivatives indicated the presence of carboxylic and phenolic groups. It is concluded that the compound is one of the phenolic acids.

3713. Sandermann, W., and Dietrichs, H.-H. Chemische Studien an Tropenhölzern.—4. Mitteilung. Chemische Untersuchungen an Teakholz. **[Chemical studies on tropical woods—4. Chemical investigations on Teak wood.]** *Holzforschung, Berlin* 13 (5), 1959 (137–48). 46 refs. [G.g.e.] P.R.

[Cf. *F.A.* 20 No. 5166.] In addition to the extractive already known (tectoquinone), the following were found: lapachonon, a polyprene consisting almost entirely of caoutchouc, and the dimeric compounds tectol ($C_{30}H_{26}O_4$) and dehydrotectol ($C_{30}H_{24}O_4$). Contents of caoutchouc, tectol, and dehydrotectol are highest in the outer heartwood, while the highest concentration of tectoquinone is in the centre of the heartwood. The effects of these extractives on lacquers, and the relation between Teak from Java, Burma and Malabar on the basis of the infra-red spectra of the extracts, are discussed.

3714. Jurášek, L. Vznik jádrových látek v bukovém dřevě jako enzymatická oxydace tříslovin. **[Formation of heartwood constituents in Beech wood [considered] as the enzymatic oxidation of tannins.]** *Drev. Výskum* 4 (2), 1959 (165–72). 14 refs. [Cz.cz. russ.g.e.] P.R.

An extract containing tannins was prepared from fresh Beech sawdust. The introduction of O into the extract caused oxidation to take place, the products of which were brown substances apparently identical with wood gums [cf. *F.A.* 19 No. 4753]. In cooked extracts, where no oxidation takes place, the formation of analogous brown substances was caused by white-rot fungi (*Stereum purpureum*, *Schizophyllum commune*). The formation of wood gums is thought to be an enzymatic oxidation of tannins. In the presence of O and polyphenol oxidase, the oxidation of polyphenols contained in tannins takes place, changing them into brown substances of chinoid nature. This oxidation is catalysed either by enzymes in the tree (in slowly dying wood), or by enzymes of white-rot fungi (in steamed wood attacked by fungi), or by both enzymes simultaneously (in living but infected wood). *From author's summary.*

3715. Selleby, L. **Birch wood constituents. Part 2. The ether extract.** *Svensk PappTidn.* 63 (4), 1960 (81–5). 8 refs. [E.e.sw.g.] P.R.

[Cf. *F.A.* 20 No. 3725.] Two sterols, β-sitosterol and β-sitostanol were isolated. Glycerides of fatty acids constituted the major part of the extract and only a small part of the fatty acids occurred in the uncombined state. Their composition was studied. *From author's summary.*

3716. Gottlieb, O. R., and Magalhães, M. T. **Occurrence of 1-nitro-2-phenylethane in *Ocotea pretiosa* and *Aniba canelilla*** *J. organ. Chem.* 24 (12), 1959 (2070–1). 9 refs. O.R.S.

The compound, responsible for the cinnamon odour of the two species, was isolated from wood and bark.

3717. Suginome, H. **Oxygen heterocycles. A new isoflavanone from *Sophora japonica*, L.** *J. organ. Chem.* 24 (11), 1959 (1655–62). 37 refs. O.R.S.

Sophorol, $C_{16}H_{12}O_6$, was isolated from the heartwood. Spectroscopic and degradation experiments showed that it is either 2′,7-dihydroxy-4′,5′-methylene-dioxyisoflavanone or 2′,7-dihydroxy-5′,6′-isoflavanone.

3718. Pacheco, H., and Brachet, A.-M. Sur les hétérosides flavoniques du bois de *Prunus* *mahaleb*. **[The flavonic heterosides of wood of *P. mahaleb*.]** *C.R. Acad. Sci., Paris* 250 (6), 1960 (1106–7). 5 refs. [F.f.] O.R.S.

A flavanone glucoside, identified as prunine, and 2 glucosides of flavanonols were extracted from the sapwood. [Cf. *F.A.* 21 Nos. 998–9.]

### 813.3. Ash Constituents

See No. 3515.

### 813.9. Wood Chemistry: Miscellaneous

See also No. 3744.

3719. SANDERMANN, W., and ROTHKAMM, M. Über die Bestimmung der pH-Werte von Handelshölzern und deren Bedeutung für die Praxis. **[The determination of pH values of woods, and their practical importance.]** *Holz Roh- u. Werkstoff* 17 (11), 1959 (433–41). 42 refs. [G.g.e.] P.R.

Discusses the importance of wood pH in relation to metal corrosion, wood discoloration, the fixing of some salts, wood preservation, glue and lacquer bonding, and the paper, pulp and fibreboard industries. The best method of measuring pH is that of Campbell and Bryant [cf. *F.A.* 3, p. 52], and this was used to determine the pH of ca. 80 woods (broadleaved and coniferous, temperate and tropical) used in the wood industry. Their buffering capacity was also determined. Results are tabulated. Further investigations included pH measurements in sapwood and heartwood, at different heights in the stem, at different times of year, and after various felling dates.

### 814. Natural Durability. Old Wood. Fossilized Wood

See No. 3792.

### 815. Effect of Growth Factors on Structure and Properties

See also Nos. 2757, 3149, 3158, 3661, 3667–72, 3674, 3701–2, 3753, 3826–7.

3720. JEFFERS, J. N. R. **Regression models of variation in specific gravity in four provenances of Sitka Spruce.** *J. Inst. Wood Sci.* No. 4, 1959 (44–59). 1 ref.

Describes the statistical methods used to investigate the variation of nominal sp. gr. in samples taken from 4 provenances of *Picea sitchensis*. Three regression equations gave reasonable approximations to the variations of sp. gr., the first two including, as independent variables, tree girth and the linear and quadratic terms of the distance from the butt of the tree and the age of the ring, and differing only in the complexity of their interaction terms. The third equation included as additional variables the width of the annual ring and m.c. of the timber at time of testing. *From author's summary.*

3721. PAUL, B. H. **The juvenile core in conifers.** *Tappi* 43 (1), 1960 (1–2). 6 refs. P.R.

Reviews from the literature the conditions in which wide-ringed juvenile or 'core' wood occurs in conifers, with its corresponding low density and high longitudinal shrinkage near the pith. These characteristics were not present in narrow-ringed wood of the same species, juvenile wood occurring only in negligible amounts in trees from closely stocked stands. The number of juvenile growth rings appears to be related to the size and relative position of the green crown, and is thus subject to control by regulated stocking in forest management.

3722. HUANG, T.-C., and LIU, Y.-J. **[The effect of growth and development on the timber quality of fast-grown *Pinus koraiensis* S. et Z. grown in Tsaohokow [Liaoning Prov.], N.E. China.]** *For. Sci., Peking* 1959 (6), (489–96). 28 refs. [Chin.e.]

Tabulates data on the physical and mechanical properties of fast-grown *P. koraiensis* from a plantation established 30 years ago. It is shown that fast-growing trees pass the juvenile stage earlier, and that there are no significant differences in strength between the wood of fast-grown planted trees and that of slow-grown trees in natural stands. [Cf. *F.A.* 20 No. 2351.]

3723. NEDBAL, F. Vlastnosti borového dřeva ze středních Čech. **[Properties of *Pinus sylvestris* from Central Bohemia.]** *Drev. Výskum* 4 (1), 1959 (39–46). 1 ref. [Cz.cz.russ.g.e.] P.R.

By means of a simple statistical method, tests on Pine from a valley and a mountain site showed that site conditions had a significant effect on the structure and properties of the wood. However, detailed analysis of the density of individual trees proved that the properties of individual trees from the same site also differed significantly; that the whole range of properties that can occur in Pine wood can be found within a single tree; and that the properties of wood from individual trees on different sites can be very similar. It is therefore argued that the investigation of site effect by the use of simple statistical methods is unsuitable, for it does not respect the significance of the tree as a biological unit to which the wood is connected. Comparison of the similarity or disparity of the properties of individual trees is therefore to be preferred. *From author's summary.*

3724. ŠKRIPEŇ, J., and RIASOVÁ, T. Vlastnosti dreva borovice obyčajnej (*Pinus sylvestris*) na Slovensku—Časť 2. Pevnostné vlastnosti a ich závislosť od stavby dreva a objemovej váhy. **[Properties of *P. sylvestris* wood in Slovakia. II. Strength properties and their relationship to wood structure and density.]** *Drev. Výskum* 3 (2), 1958 (137–69). 5 refs. [Slovak.slovak.russ.g.e.] P.R.

In further experiments on the same material [see *F.A.* 20 No. 2353] the following measurements were made: (*a*) compression ||, (*b*) static and (*c*) impact bending strength, and the relations of these strengths to fibre length, late-wood % and density. Results are tabulated and graphed. Slovakian mean strength values were, for (*a*) 490 kg./sq. cm. (range 230–730); for (*b*) 982 kg./sq. cm. (335–1550); and for (*c*) 0·47 kg./sq. cm. (0·12–1·07). Spiš and W. Slovakian Pines had the best strength values, and those from Šariš the worst. Values for (*a*) and (*b*) were linearly related to tracheid length, i.e. increasing from the pith outwards, but in the sapwood neither fibre length nor strength changed. Values for (*a*) were also linearly related to late-wood % and density. It was not possible to show clearly a superiority in wood strength of élite over ordinary stems, or of natural over planted trees. The decisive factor for strength properties was wood density, which was determined mainly by site conditions.

3725. MITCHELL, H. L. **The possibilities of using forest survey to locate individual trees that are superior with respect to wood quality as well as form and growth rate.** *Proc. 6th Ntheast. For. Tree Impr. Conf. 1958*, 1959 (8–18). 9 refs.

Chiefly discusses the variations of sp. gr. in Southern Pines in Mississippi with species, age and environment [cf. *F.A.* 20 No. 5305; 21 No. 960]. The increment-core sp. gr. of *Pinus echinata* and *P. taeda* tended to increase from the South to the North, particularly for the older *P. taeda*.

3726. MITCHELL, H. L., and WHEELER, P. R. **Specific gravity—a measure of intrinsic wood quality.** *Proc. Soc. Amer. For. 1959*, 1960 (53–7).

Discusses the sampling of trees by increment cores when cruising pulpwood stands, with particular emphasis on sp. gr. The possibility of selecting breeding material with high sp. gr. is also touched on. [Cf. *F.A.* 20 No. 5305.]

3727. ECHOLS, R. M. **Effects of growing space on wood specific gravity in Loblolly Pine.** *Proc. Soc. Amer. For. 1959*, 1960 (140–3). 15 refs.

Reports on a study in a 40-acre *Pinus taeda* plantation in central Louisiana. Initial spacings were (*a*) 4 × 4, (*b*) 6 × 6, (*c*) 8 × 8, and (*d*) 10 × 10 ft. Survival was excellent. At 20 years, in 1948, light, medium and heavy thinnings were made in each spacing; but on some plots in each spacing, except (*a*), thinning was deferred until 1953, when the previous thinnings were repeated. No significant difference was found at 20 years in sp. gr. of the wood as a result of different spacings. Diameter growth, however, was greater in (*d*) and least in (*a*). During the 10-year period after thinning, changes in sp. gr. occurred, probably reflecting to some extent the influence of initial spacing, but showing little effect of thinning. For all 4 thinning variables, (*b*) showed the greatest gain in sp. gr. over the 10-year period. Plots (*c*) had the highest volume increment; those thinned lightly in 1948 had the highest pulp yield at 30 years, and those with medium, heavy, and deferred thinnings ranked second, third, and fourth, respectively.

3728. MILLER, S. R. **Variation in inherent wood characteristics in Slash Pine.** *Proc. 5th Sth. Conf. For. Tree Impr., Raleigh 1959*, 1959 (97–106).

Describes investigations on 96 phenotypically similar trees (d.b.h. from 7 to 11 in.) on 4 sites near Savanna, Ga., differing chiefly in drainage. Neither site, d.b.h. or season of cutting was significantly correlated with sp. gr. (here defined as oven-dry weight/green volume), or m.c. (weight of water/oven-dry weight). M.c. was negatively and sp. gr. positively, related to late-wood %. Sp. gr. was negatively correlated with m.c. and height from the ground. M.c. increased with height, so that green density was independent of height. Sp. gr. of the butt log was closely correlated with the sp. gr. of the whole tree.

3729. DAVIS, E. M. **Machining Ponderosa Pine and Douglas Fir—effect of growth rate and density.** *For. Prod. J.* 10 (1), 1960 (1–3).

In tests that included planing, shaping, turning, boring and mortising, on Douglas varying from 9 to 21 rings per in. and Ponderosa Pine from 8 to 28, the slow-grown material performed better than fast-grown of similar sp. gr. The effect of sp. gr. was small, though the heavier woods performed somewhat better.

## 82. Conversion, Shaping, Assembly and Finishing of Wood: General

### 822. Saws and Sawing

See also Nos. 3736, 3757, 3829.

3730. PĚNIČKA, K., and ŘEHAK, J. Stabilita pilových listů rámových pil. [**The stability of frame-saw blades.**] *Drev. Výskum* 3 (2), 1958 (263–82). 11 refs. [Cz.cz.russ.g.e.] P.R.

An account of laboratory investigations on the effect of blade dimensions, tension stresses, and the degree of rolling, on blade stability. The relationships are graphed.

3731. BARZ, E. Prüfgeräte für den Richt- und Spannungszustand von Kreissägeblättern. [**Devices for testing the straightening and tension of circular-saw blades.**] *Holz Roh- u. Werkstoff* 18 (1), 1960 (19–25). 7 refs. [G.g.e.] P.R.

Describes the use of the RSK 4 and RSK 5 devices of German manufacture.

3732. JONES, D. S. **How much lead should be applied to circular saw breaking-down machines.** *Aust. Timb. J.* 25 (10), 1959 (48 . . . 57).

Presents brief theoretical arguments against the use of lead, however small, with large circular saws, mentioning the troubles arising out of the lack of parallelism with the feed direction. The serious lack of reliable experimental evidence on the merits of lead is stressed.

3733. JAKUNIN, N. K., BEKKER, I. G., and SOROKIN, I. A. Mnogopil′nye kruglopil′nye stanki dlja raspilovki tonkomernogo lesa. [**Multiple circular saws for sawing small wood.**] *Derev. Prom.* 8 (4), 1959 (16–7). [Russ.] P.R.

Description, brief specification and general results of tests of the T-92 4-bladed saw and the T-94 8-bladed saw. The T-92 is intended for logs up to 260 mm. diam.; the T-94 for squared wood up to 160 mm. thick and 300 mm. wide.

3734. BEROLZHEIMER, C. P., and BEST, C. H. **Improvements through research on thin circular saw-blades.** *For. Prod. J.* 9 (11), 1959 (404–12). 27 refs.

Describes experiments and testing equipment, including an oscillograph for the indication of small distortions in a rotating blade, to investigate some of the problems caused by excessive flexibility, proneness to vibrations and sensitivity to thermal gradients. Expansion apertures near the rim relieved compressive stresses there and cooled the blade. A pilot machine for the pencil industry was constructed, in which 10 tapered, carbide-tipped, 16-in. blades, 0·122 in. thick at the arbor and 0·032 in. at the rim, were mounted in close echelon to cut in turn a 2·8 × 2·63 × 7·25-in. block of *Libocedrus decurrens* into 11 instead of the usual 10 slats, each being 0·2 in. thick, with kerf $< 0·05$ in.

3735. MACKRIN, G. **Proper blade selection reduces particle board costs, ups quality.** *Wood Wkg.* 60 (12), 1958 (38–40). P.R.

Examines the relationship between kerf and the degree of tear out, abrasion and pile-up on the cutting edge caused by the resins and glues used in making chipboard. Samples of the material were cut with various types of circular saw, blades of different hook, pitch, sharpness angle, etc., being used in turn on each machine, and suggestions are made for optimum cutting speeds and kerf thickness in each case. For trimming chipboard laminated with brittle veneers such as Philippine Mahogany and Oak, the use of a special design of carbide tip is recommended to avoid chipping.

### 823. Planing. Cutting of Mouldings. Chiselling, Mortising and Tenoning. Boring. Turning

3736. **New products and literature.** *For. Prod. J.* 9 (12), 1959 (8*A*–9*A*).

Includes illustrated descriptions of a flaker-surfacer (S. A. Woods Machine Co., Boston), which produces flakes in adjustable sizes, instead of planer shavings and sawdust, from the excess material of rough lumber to be finished, at speeds of up to 1000 linear ft./min.; also a 'power hand-saw' with a heavy-duty A.C./D.C. electric motor (Wells Manufacturing Co., Three Rivers, Mich.) whose reciprocating blade cuts on both forward and return strokes to provide 8000 1⅛-in. cutting strokes/min. The manufacturer claims that it provides the accuracy, versatility, and convenience of the hand-saw plus the speed and efficiency of a power tool.

### 824. Forms of Joint. Jointing and Assembly

#### 824.1. Nailed Joints

3737. BOYD, L. L. **The rigidity of nailed timber joints.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (7), 1960 (2719). O.R.S.

Studies were made, in which the rotation of nailed timber joints was considered as a function of the geometry of the joint, the properties of the timber and nails, and the forces on the joint. Variables considered were: the moment applied to the joint; the sp. gr., depth, and thickness of the timber; the length of the joint; the number of nails used; their distance from the centre of gravity of the nail pattern; their diameter; their penetration; and the proportional limit of the nail steel. Two loading conditions—moment only, and moment and shear—were considered, and general equations are presented for each.

#### 824.2. Screwed Joints

3738. KNOHL, F. K. **Fastener design and costs.** *For. Prod. J.* 9 (12), 1959 (464–6).

Discusses the merits—chiefly as regards labour saving—of modern screw designs such as washer heads, 'nib-screws' with protrusions under the head to reduce excessive driver torque, screws with a large left-hand and a smaller right-hand thread, drill-point screws etc.

#### 824.8. Glues and Gluing

See also Nos. 3633, 3761–2.

3739. LEWIN, M. **Wood and plastics.** [*Docum.*] *8th Sess. FAO Tech. Panel Wood Chem., Wiesbaden 1959* No. *FAO/WCP* 59–1, 1959. pp. 35. 131 refs. Limited distribution. (Also in *Bull. Res. Coun. Israel 7C* (2), 1959 (81–112).)

A review, covering: (1) the use of plastics as glues and to improve the resistance of wood to fungi, animals, fire, and dimensional changes; (2) moulded wood/plastic products; (3) the manufacture of plastics and adhesives from wood and its chemical components; and (4) the use of radiation for improving the properties of wood and wood products (by facilitating the polymerization of monomers introduced into wood, grafting polymers on to wood, and simplifying the curing of resins), and its limitations.

3740. WEINBRENNER, R. [Editor]. Holz und Kunststoffe. **[Wood and plastics.]** *Holzwirtschaftliches Jahrbuch, Stuttgart* No. 8, [1959]. pp. 372. [G.] P.R.

A handbook for the practical man, discussing in 10 articles by different authors the manufacture, properties, utilization, machining and treatment of materials combining plastic substances and wood—laminates, composite boards, densified and other improved woods, resin-bonded mouldings etc., and auxiliary plastic materials used in conjunction with wood—glues, lacquers etc. There is a list of German manufacturers and their products (including fibre and particle boards) and of the advertisers, in an 100-page advertisement section.

3741. **Auckland symposium on N.Z. exotics utilization.** *N.Z. Timb. J.* 6 (5), 1960 (46, 49).

Reproduces two papers by *A. G. Stanger*: (1) The compatibility of certain glues and water-borne preservatives used for gluing [*Pinus*] *radiata* sapwood [the preservatives, a polyborate, a Cu-Zn-Cr-arsenate, and a Cu-Cr-arsenate, proved to be compatible with the glues (urea-formaldehyde, melamine-fortified urea-formaldehyde, and resorcinol formaldehyde), provided that the wood was brought to 11–14% moisture content at the time of gluing, with freshly machined and clean surfaces]. (2) The effect of scarf joints on the strength of laminated [*Pinus*] *radiata* beams [detailed results will be published elsewhere].

3742. HIRST, K., and PLOMLEY, K. F. **Influence of arsenic trioxide on bond strength and setting time**

**of phenolic glues.** *Holzforschung, Berlin* 13 (6), 1959 (182–4). [E.e.g.] P.R.

$As_2O_3$ was added to phenolic glues at various concentrations, and the mixes used to glue joints of several species of wood. The shear strength of these joints was compared with that of controls glued without $As_2O_3$. Addition of 1–5% $As_2O_3$ increased shear strength and all additions substantially decreased the setting time of a phenolic resin of pH 9–12. *From authors' summary.*

3743. Berger, V., and Škripeň, J. Príspevok k objasneniu vplyvu kyslého tvrdidla na drevo pri lepení fenolvými lepidlami (Umacolum B). **[The effect of acid hardener on wood in gluing with phenolic glues (Umacol B).]** *Drev. Výskum* 4 (1), 1959 (107–20). 8 refs. [Slovak.russ.g.e.] P.R.

The hardener used in Umacol B consists of a 50% solution of *p*-toluene-sulphonic acid. The effects of this on wood in gluing was investigated by strength tests on Beech and on Pine sapwood, exposed for one month at ca. 20° C. to concentrations of the acid varying from 2·6 to 65 mg./c.c. The acid had least effect on compression strength, but bending, shear and impact strengths were reduced to 70–85% of the initial values by the acid, even in quantities as small as 5 mg./c.c.

3744. Freeman, H. A. **Relation between physical and chemical properties of wood and adhesion.** *For. Prod. J.* 9 (12), 1959 (451–8). 14 refs.

A study, using laminated 2-ply blocks of 22 American hardwoods, U.S. and tropical, varying greatly in sp. gr., pH, and wettability, and two glues, (*a*) a urea-formaldehyde and (*b*) a two-compound resorcinol-phenol resin. For (*a*) boards with wood of $< 0{\cdot}80$ sp. gr., shear strength was most influenced by rising sp. gr., to a lesser extent by rising wettability, and not significantly by pH. For the denser woods, sp. gr. was not significant, but shear strength rose with falling pH and to a lesser extent with rising wettability. In (*b*) boards, strength increased with sp. gr., falling pH, and increased wettability, over the whole sp. gr. range, but the effect of pH and wettability was less than with (*a*). With (*a*), assembly times almost three times as great as those recommended by the manufacturers were not harmful and, for some dense woods, were beneficial.

3745. Clad, W. Über das Verhalten von Holzverleimungen mit Kauritleimen und Kauresinleimen bei Frosteinwirkungen. **[The behaviour of joints glued with Kaurit [urea-formaldehyde] and Kauresin [phenol-resorcinol-formaldehyde] when frozen.]** *Holz-Zbl.* 86 (26), 1960 (397–8). 27 refs. [G.]

Includes a description of tests with various formulations on Beech wood (including Beech plywood) exposed to − 55° C. for 24 hours. No reduction in glue-bond strength was found.

## 825. Cleaving. Adzing. Mechanical Comminution

See No. 3846.

## 826. Peeling. Slicing. Trimming, Edging etc. of Thin Sheets

See also No. 3634.

3746. Lutz, J. F. **Heating veneer bolts to improve quality of Douglas-Fir plywood. Part I.** *Veneers & Plyw.* 54 (2), 1960 (12 . . . 16). P.R.

Describes 3 methods of heating veneer bolts—hot water, steam, and diathermy—and discusses the merits of each. The effects of heating on sapwood, and on veneer smoothness and tightness are briefly examined.

3747. Grantham, J. B., and Atherton, G. H. **Heating Douglas Fir veneer blocks—does it pay?** *Bull. Ore. For. Prod. Res. Cent.* No. 9, 1959. pp. 64. 27 refs.

In experiments on heated and unheated blocks from two grades of veneer log, the % of A-grade veneer from high-grade logs increased from 48 when unheated to 60 when heated, chiefly as a result of reduced splitting. Cost of heating is estimated at $0.82/1000 bd ft., giving a net value gain of $4.35.

3748. Prokeš, S. Krájení smrkových a bukových prkének. (Vliv různých podmínek při krájení na drsnost povrchu). **[Slicing Spruce and Beech into slats. (Effect of various slicing conditions on surface roughness).]** *Drev. Výskum* 4 (1), 1959 (121–45). 3 refs. [Cz.cz.russ.g.e.] P.R.

[Cf. *F.A.* 19 No. 4853.] Reports investigations on a pendulum and a reciprocating slicing machine. Surfaces of slats (60·5 mm. wide, 1–9 mm. thick) cut from boiled wood were somewhat smoother than those from steamed wood. With Spruce, a pressure-bar lead of 3 mm. was best, but with Beech, lead made no difference. It was best to slice immediately after heating, i.e. Spruce at $\nless$ 80°, Beech at $\nless$ 85° C. A knife sharpness angle of 20° proved satisfactory. In slicing slats from 1 to 9 mm. thick, Beech slats were smoothest at 3–4 mm.; in Spruce smoothness was not affected by slat thickness in the range investigated. Feed speed (in the range 0·17 to 0·84 m./sec.) and m.c. of wood before heating (Spruce 8·6–35%; Beech 15–56%) had no significant influence on surface smoothness.

3749. Prokeš, S. Krájení smrkových a bukových prkének. Vliv různých podmínek při krájení na příčné prohnutí, trhliny, odlomy a tloušt'ku prkének. **[Slicing Spruce and Beech into slats. Effect of various slicing conditions on transverse deflection, checks, end break-off, and slat thickness.]** *Drev. Výskum* 4 (2), 1959 (251–88). 1 ref. [Cz.cz.russ.g.e.] P.R.

[Cf. preceding abstract.] Transverse deflection was influenced by (1) the angle of the annual rings to the direction of slicing, (2) wood temperature, (3) cutting angle, (4) water temperature, (5) slat (or veneer) thickness, and, to a lesser but still significant extent, by (6) the pressure-bar lead and (7) the wood m.c. before heating. Transverse deflection in Beech was 2–5 times that in Spruce. The depth of checks depended on (4), (6), (2) and (3). Checks were deeper in Beech than in Spruce. The extent of end break-off was influenced mainly by wood structure and by (1). Slat thickness was influenced by the relative position of the knife edge and pressure bar, and, to a lesser extent, by feed speed, and the duration and temperature of heat treatment. All the relationships are graphed.

### 827. Bending. Moulding (other than by Cutting)

See also Nos. 3771, 3819.

3750. RAK, J. Přispěvek k hodnocení plastifikace dřeva. **[On the softening of wood.]** *Drev. Výskum* 3 (2), 1958 (189–205). 12 refs. [Cz.cz.russ. g.e.] P.R.

Green Beech test pieces (1·5 × 1·5 × 22·5 cm.) were boiled in water for 6, 10, 15, 20, 90 and 345 min., and then their degree of flexibility, $x$, was determined by bending tests as follows:

$$x = \frac{y}{P} r_0 \cdot 100$$

where $y$ = deflection of test piece (mm.), $P$ = load (kg.), and $r_0$ = wood density (g./c.c.). It was found that $x$ increased from the beginning of the softening process until the middle of the test piece reached 100° C. (6 min. in this particular case), but changed very little thereafter. The physico-chemical changes occurring in wood during softening are discussed.

### 829.1. Finishing

See also Nos. 3631, 3635, 3713.

3751. MCGINNIS, I. L. **Polyurethane coatings for wood.** *For. Prod. J.* 10 (3), 1960 (129–30).

Chief advantages discussed are outstanding toughness, abrasion resistance and chemical resistance; chief drawbacks a short pot life, a tendency to yellowing, pigmentation problems and toxicity both in manufacture and use.

## 83. Timber Manufacturing Industries and Products. Uses of Wood as Such

### 831. Fuelwood and Various Types of Rough Timber

See also Nos. 3614, 3617, 3780–1, 3808, 3828.

3752. CARRAPIETT, J. B. **Wood burning in Burma.** *Burmese For.* 9 (1), 1959 (11–4 + 2 sets of drawings).

Describes the stoves used, types and dimensions of fuelwood, and prices of wood and other fuels.

3753. KOLLMANN, F., *et al.* Vergleichende Untersuchungen an deutschem und schwedischem Kiefernholz für Masten. **[Comparative investigations on German and Swedish Pine for poles.]** *Holz Roh- u. Werkstoff* 17 (12), 1959 (474–83). 5 refs. [G.g.e.] P.R.

Gives results of analyses of wood of pole quality from 152 Swedish (S) trees from several localities, and from 150 German (G) trees: mean density 0·546 g./c.c. (S), 0·583 (G); mean ring width 1·20 mm., 1·09; summerwood % 31·4, 35; heartwood % 27·5, 35·7. Mean resin content of S heartwood was slightly below the G mean value. There were no significant differences in knottiness. The total mean values of strength properties for sound specimens were higher for G than for S. In S, strength decreased slightly from N. to S. provenances. S retained ca. 8·3% more creosote than G. *From authors' summary.*

3754. LEBACQ, L., BOSCH, P. VAN DEN, and SMETS, W. Supports d'alignement en bois pour lignes aériennes de haute tension au Congo belge et au Ruanda-Urundi. **[Wooden supports for aerial H.T. lines in the Belgian Congo and Ruanda-Urundi.]** *Bull. agric. Congo belge* 50 (5), 1959 (1337–74). 2 refs. [F.f.du.]

Establishes the required specifications for the Belgian Congo. *Eucalyptus* spp. were tested at Usumbura, with particular reference to *E. saligna*. Compared with results obtained in South Africa [cf. *F.A.* 17 No. 888], *E. saligna* and *E. microcorys* showed a considerably higher modulus of rupture. Details are given of testing techniques used, and it is suggested that poles of 15 m. should be sought in regions above 1800 m. alt. At Yangambi local species were examined and it was concluded that *Polyalthia suaveolens* (modulus of rupture ca. 1500 kg./sq. cm.) would provide excellent transmission poles. *Scorodophloeus zenkeri* appeared adequate for L.T. and telephone lines. Theoretical and constructional details are given for the Lebacq preservative process [cf. *F.A.* 17 No. 2113] as adapted for poles. The cost of production per pole ready for erection is calculated for Ruanda-Urundi (Fr.917) and Kivu-Stanleyville (Fr.1067).

### 832. Mills, Their Functions and Products

3755. **[Automation in the woodworking industry.]** *Holz Roh- u. Werkstoff* 18 (1), 1960 (1–19). [G.e.] P.R.

Three articles: Automation in sawmills (*B. Thunell*); Automation in plywood factories (*H. Doffiné*); Automation in chipboard factories (*F. Fahrni*).

3756. BROADHURST, V. A. **Fire regulations in woodworking factories.** *Timb. Technol.* 68 (2248), 1960 (53, 55–6).

Statistics indicate an increase in the number of legally notifiable fires in woodworking factories. Common faults, such as the accumulation of waste wood near machinery, and inadequate wiring, are discussed, and precautions outlined.

### 832.1. Sawmills and Planing Mills

See also Nos. 3614, 3617, 3619, 3625–6, 3730–6, 3755.

3757. CERMAK, F. L'industrie du sciage au Paraguay. **[The sawmilling industry in Paraguay.]** *Bois For. Trop.* No. 68, 1959 (39–49). [F.e.span.]

A general account of the equipment, size and capacity of the mills, with some remarks on saw-setting, rate of feed, power, etc.

3758. GRGURIĆ, S., and HORVAT, B. Proizvodnost rada na industrijskim pilanama Hrvatske. **[Productivity in industrial sawmills in Croatia.]** *Drvna Ind.* 10 (11/12), 1959 (179–91). [Croat.g.] P.R.

A detailed analysis for the period Jan.-Sept. 1959.

In all, 35 mills are involved, which handled 512,006 cu.m. during the period (122,805 cu.m. being softwoods).

3759. CAMPBELL, R. A. **Overrun in second-growth Yellow-Poplar [*Liriodendron tulipifera*].** *Res. Note Stheast. For. Exp. Sta.* No. 139, 1959. pp. 2.

Presents a table of board feet and % overrun by log grade, and a graph of the relation of log diameter to % overrun by Scribner and Decimal C and International $\frac{1}{4}$-inch Rule, based on logs from the Southern Appalachians sawn in two band mills. [Cf. *F.A.* 16 No. 4595.]

3760. CAMPBELL, R. A. **Does site affect grade yield?** *Proc. Soc. Amer. For. 1959*, 1960 (50–3).

The possibility that site quality might affect lumber grade yield within log grades became apparent during analyses of grade yield for second-growth *Liriodendron tulipifera*. In a further study, logs of each grade, from trees of known site index, were subjected to regression analysis to determine the effects of site, log size, and combined effects of mills and graders. The results indicated that site was the only significant variable affecting the quality index of Grade-1 logs, which ranged from 88 to 112 as site index went up from 70 to 130 ft. Log diameter varied from 13 to 22 in., but log size did not significantly affect quality index. For Grade-2 logs the differences caused by site alone were less than for Grade 1, and amounted to 10 quality-index points for logs of the same size, as site index went up from 70 to 130 ft. Log size affected quality index in Grade-2 logs, quality index increasing ca. 0·9 points per inch of increase in log diameter. The analysis of Grade-3 logs indicated that site, log size, and combined effect of mill and grader were all important. [Cf. *F.A.* 21 No. 3544.]

### 832.2. Veneer and Plywood Mills, including the Manufacture of Composite-Wood Assemblies

See also Nos. 3616, 3631, 3637, 3739–48, 3755, 3779, 3852.

3761. NORTHCOTT, P. L., *et al.* **Undercure . . . casehardening in plywood.** *For. Prod. J.* 9 (12), 1959 (442–51). 26 refs.

Describes experiments at the Forest Products Laboratories, Vancouver, chiefly with Engelmann Spruce [cf. *F.A.* 20 No. 3796], but also Douglas Fir, *Populus trichocarpa* and one of the western *Abies*, probably *A. amabilis*, on the effect of veneer history [see below], moisture content, assembly and press times, sanding, and glues, on the quality of bonds in external plywood as expressed by wood failure or other tests. It was concluded that undercure is a major cause of glue failure in conifer plywood, and that this condition may be caused or aggravated by a veneer history such as drying at excessive heat or for too long, storing too long and re-adsorption of moisture, causing a reduction in the hygroscopicity or wettability of the surface of the veneer, and leading to the gluing difficulties referred to by some as 'case hardening', which can often be relieved by sanding. Accelerated weathering tests suggest that such bonds improve in service. There were considerable differences between species and glues and their interaction, in liability to produce this condition. The fact that phenolic bonds in coast-grown Douglas Fir were the least sensitive to gluing conditions is thought to indicate, not an inherent property of the wood, but the high degree of adaptation of the glue to the species most frequently used.

3762. RAYMOND, R. C. **Exterior gluing of low-grade Douglas-Fir veneer.** *For. Prod. J.* 10 (1), 1960 (36–41).

Boil/shear and other tests to ascertain whether grades lower than 'C' could be used for exterior-type plywood indicated that with increasing size of knot holes, low-pressure areas developed that progressively reduced glue-line strength, and surface checking increased. Pitch streaks also reduced glue-line strengths. Knots ≯ 1 in. in diameter (as currently permitted in exterior plywood veneers) caused no quality reduction.

3763. ELMENDORF, A., and VAUGHAN, T. W. **Means for reducing the checking of Douglas Fir plywood.** *For. Prod. J.* 10 (1), 1960 (45–7).

Tests with natural (5–10 years) and accelerated weathering indicated that making parallel incisions $\frac{3}{16}$ in. apart across the face veneer, before or after bonding, relieved stress and prevented checking. In the light of these findings, an investigation was made into the checking of Douglas Fir plywood subjected only to changes in atmospheric humidity, to see if there might be some correlation between checking and loose cutting of the veneer. The tests led to some very surprising results: (1) Stress-relieving eliminated checking irrespective of whether the tight or the loose side was cut. (2) Checking was much more conspicuous in panels with the tight side out. (3) Within the limits of the tests, no correlation could be established between looseness of cutting and checking. (4) Within the limits of the tests, no correlation could be established between rapid growth and checking; of the panels tested those made of veneers from slow-grown wood checked more conspicuously than those made of fast-grown wood.

3764. EADES, H. W., and ROFF, J. W. **Relative decay resistance of Western Hemlock and Douglas Fir plywood and the effect of weathering.** *Timber of Canada* 21 (2), 1960 (70 . . . 85). 4 refs.

In laboratory tests using *Poria incrassata* and *Lenzites saepiaria*, the decay resistance (d.r.) of unweathered Douglas Fir and Western Hemlock plywood made with phenol-formaldehyde glue was much greater than that of solid unlaminated wood of similar origin and dimensions. D.r. of plywood made from sapwood was similar to that of plywood made from heartwood of the same log. The d.r. of Hemlock plywood was only slightly less than that of Douglas. The d.r. of $\frac{5}{8}$-in. (5-ply) sheets was greater than that of $\frac{3}{8}$-in. (3-ply) sheets of the same species, weathered similarly. The d.r. of plywood severely weathered under laboratory test conditions was much lower than that of unweathered, and approximated to that of solid wood of the same size and species.

### 833. Timber in Buildings and Engineering Structures (Manufacture and Use)

### 833.1. Building Components and Fittings: General

See also Nos. 3691, 3769, 3782–3, 3891.

3765. **Wood flooring.** Timber Development Association, London. 1959. pp. 27 + 12 photos. 2 refs.

A ready-reference booklet for architects and building contractors, including chapters on the properties of wood flooring; types of floors (hardwoods and softwoods), including the conversion of timber for flooring; hardwood and softwood block flooring; end-grain paving; parquet flooring. A large but not exhaustive list of recommended woods is given. Methods of floor construction are covered in a companion booklet [see *F.A.* 20 No. 5222].

### 833.2. Special Uses in Residential, Commercial and Public Buildings

3766. BURGESS, H. J. **Houses for the poor.** *Malay. Forester* 22 (4), 1959 (287–91 + 4 photos).

Reviews progress in the design of cheap, prefabricated wooden houses for use in Malaya. [Cf. *F.A.* 20 No. 5223.]

3767. DELVAUX, J. Le rondin, matériau de construction durable. **[The round log, a durable building material.]** *Bull. agric. Congo belge* 51 (1), 1960 (101–14). [F.f.du.]

A note on the use of round logs for building small dwellings in the Belgian Congo. Preparation and preservative treatment of the logs, and methods of construction are described, with diagrams.

3768. ATHERTON, G. H. **Trends in the use of boards in residential construction.** [Forest Products Research Center, Corvallis, Oregon.] [1959]. pp. 19. 5 refs.

Contains information on quantity, grades and sizes of 1-inch common lumber produced in Oregon, end-uses with particular reference to housing, the reasons for the falling trend in demand and methods of developing demand.

### 833.3. Special Uses in Factories and Workplaces

3769. **Timber roofs for factory buildings and the Thermal Insulation (Industrial Buildings) Act 1957.** Timber Development Association, London. 1959. pp. 20. 9 refs.

Discusses the scope of the Act with regard to the structural and insulation uses of timber. Methods of treating timber and timber products for flame-resistance, while making the best use of the valuable properties of timber in other respects, are examined.

### 835. Industrial and Domestic (Utility) Woodware. Toys and Models. Sports and Recreational Goods. Musical, Scientific and Mathematical Instruments. Surgical Applications etc.

See Nos. 3633, 3734, 3785.

### 839.8. Industrial Waste Wood, its Processing and Uses

See also Nos. 3736, 3752, 3839, 3859, 3917.

3770. JIRŮ, P. Určení minimálních rychlostí vzduchu pro pneumatickou dopravu, sušení a třídění třísek a dřevěných drtí. **[Determining the minimum air speeds for pneumatic conveying, drying, and sorting of chips and wood particles.]** *Drev. Výskum* 3 (2), 1958 (243–62). 5 refs. [Cz.cz.russ.g.e.] P.R.

The experiments showed that for conveying softwood chips, air speed should be $\nless$ 9 and for hardwood chips $\nless$ 12·5 m./sec., at a volume mixing ratio (chips/air) of 1/500 to 1/1000. For drying chips in circulation kilns, the same air speeds are recommended, at a mixing ratio depending on the moisture sorption of the air. For gravity sorting of chips, a chamber 14 m. long or air speeds 0·2–6 m./sec. are required.

3771. MININ, A. N. Vlijanie osnovnyh tehnologičeskih faktorov na deformacii izmel′čennoj drevesiny. **[The influence of the main schedule factors on the deformation of comminuted wood.]** *Derev. Prom.* 8 (4), 1959 (8–12). [Russ.russ.] P.R.

[Cf. *F.A.* 21 No. 2539.] From investigations on the pressing of comminuted wood (mainly softwood sawdust), the following conclusions were drawn: in pressing in moulds, total deformation (t.d.) increases with increasing hygroscopic moisture of the material. When pressing at room temperature, plastic deformation (p.d.) decreases and elastic deformation (e.d.) increases with increasing wood m.c. up to the fibre saturation point. In hot-pressing, after the removal of pressure and until intensive evaporation of intermicellar moisture occurs, p.d. decreases and e.d. increases with increasing hygroscopic moisture in the material, owing to reduced internal friction forces; after this evaporation, p.d. increases and e.d. decreases with increasing hygroscopic moisture in the material, owing to increased internal friction. T.d. increases with increasing temperature of the material (from 20 to 180–220° C.) at the moment of pressing. In hot-pressing, after the removal of pressure and until the period of maximum fluidity of the material, p.d. decreases and e.d. increases with increasing press temperature, owing to reduced internal friction; after this period of maximum fluidity, p.d. increases and e.d. decreases with increasing press temperature. In pressing sawdust at 180–220°, t.d., p.d. and e.d. increase with the specific pressure, particularly in the range 0–30 kg./sq. cm., less so for 30–300, and negligibly for 300–4000 kg./sq. cm. T.d. and p.d. increase, and e.d. decreases, with increasing pressing time at high temperatures.

### 84. Preservation and Other Treatments to Improve the Properties of Wood. Damage by Biological Agencies and its Control. Seasoning. Timberyard Practice

### 841. Wood Preservation

See also Nos. 3631, 3637, 3703–4, 3741, 3754, 3767, 3788, 3793, 3796, 3798, 3800–2, 3808.

3772. BRUCE, W. E. **Wood preservation with particular reference to Great Britain.** [*Docum.*]

*FAO Meeting on Wood Preservation, Rome 1959* No. *FAO/WT/59/P*-2, 1959. pp. 9. Limited distribution.

Discusses wood preservatives and also fire retardants in common use, standards for chemicals and their application, testing in laboratory and in service, and regulations by statute, bye-laws (very few except for fire protection), etc.

3773. FERGUSON, E. R. **Wood treated with penta [PCP] can damage Pine nursery seedlings.** *Tree Plant. Notes* No. 38, 1960 (21–2).

Experiments were made in raising Southern Pine seedlings (*Pinus elliottii*, *P. taeda*, *P. echinata* and *P. palustris*) in wooden flats treated with (*a*) PCP, (*b*) diesel oil, and (*c*) Cu naphthenate (2% metallic Cu). Two months after sowing, flats treated with (*a*) had $< 10\%$ of Slash, Loblolly or Shortleaf Pine seedlings alive, whereas there was no mortality in (*b*) or (*c*) flats. Longleaf Pine appeared to be relatively immune to PCP. [Cf. *F.A.* 16 No. 3513.]

3774. SCHIPPER, I. A., and ANDERS, R. **A preliminary report—toxicology of wood preservatives to swine.** *North Dakota Farm Research, Fargo* 21 (1), 1959 (8–11). O.W.

Wood preservatives containing PCP or creosote, when used on the timber of farrowing pens, proved extremely toxic to the sows and piglets. The effects were most severe when sows had direct contact over an extended period with freshly treated timber containing excessive quantities of wood preservatives. Liberal amounts of bedding helped to mitigate these effects. When, however, preservatives were properly applied to wood that had been thoroughly dried, harmful effects were negligible. *From authors' summary.*

3775. WILSON, W. J. **The detection of preservatives in wood with pyrocatechol violet.** *Analytica Chimica Acta, Amsterdam* 21 (2), 1959 (150–4). 4 refs. [E.e.f.g.] P.O.

Pyrocatechol violet was used successfully to detect $As^{5+}$, $BO_3^{3-}$, $Cu^{2+}$, $Cr^{3+}$, $Cr^{6+}$, $Zn^{2+}$ and $F^-$ in treated wood of *Pinus radiata* and *Dacrydium cupressinum*.

3776. YONEKAWA, S. **Ammonium copper pentachlorophenate. A new water-soluble preservative.** *Transl. For. Prod. Lab. Can.* No. 213, 1959. pp. 15. 11 refs. *Transl.* from *Wood Ind., Tokyo* 11 (3), 1956 (143–50). [See *F.A.* 17 No. 3364.] Limited distribution.

3777. **Transportable treatment plant.** *FAO For. Equipm. Note* No. *E*.19.1959, 1959. pp. 2.

Gives specification and scale plan. Manufactured by AHIG-Holzschutzmittel, Dr. Wolman G.m.b.H., Sinzheim bei Baden-Baden, W. Germany.

3778. SMITH, D. N., and PURSLOW, D. F. **Preservative treatment of Pine sapwood by nonpressure methods.** *Timb. Technol.* 68 (2248), 1960 (67, 69–71, 76). 1 ref.

In continued work [cf. *F.A.* 19 No. 4912] it was found that although the amounts of the 5 types of preservative absorbed did not vary greatly, there was a big difference in their penetration depths—PCP types giving the deepest, and water-borne types the least penetration. Further investigation showed that there was very little to choose between short-term dipping, brushing or spraying for applying the usual types of wood preservative: 1 spray or 1 brush coat gave practically the same results as a 10-second dip; 3 brush coats were ca. the equivalent of a 10-min. dip.

3779. TAMBLYN, N., COSTA, E. W. B. DA and GAY, F. J. **Preservative treatments for plywood by momentary dipping of green veneer.** *Div. For. Prod. technol. Pap. For. Prod. Aust.* (*n.s.*) No. 6, 1959. pp. 8. 3 refs.

The success of a previously developed cheap and simple dip-diffusion process [see *F.A.* 11 No.1325] led in 1953 to tests in which rotary-peeled $\frac{1}{10}$-in. green heartwood veneers of *Eucalyptus diversicolor* and *E. regnans* were treated with 6 water-borne preservatives by dipping momentarily in cold solutions and then block [bulk]-stacking the wet sheets for 2 hr., before drying, to allow diffusion into the wood. With solutions of 7·6% concentration, mean dry salt retention was 0·29 and 0·22 lb./cu. ft. for the two timbers respectively, at which figures $Na_2B_{10}O_{16}$ gave good protection against *Coptotermes acinaciformis* and *C. lacteus*, but was less effective against B-tolerant *Nasutitermes exitiosus* (on small blocks of $\frac{1}{2}$-in.-thick veneer-bonded plywood). Complete protection, however, was obtained against the three test fungi; (i) *Coniophora cerebella*, (ii) *Trametes lilacino-gilva*, and (iii) *Lenzites trabea*. A 3/2 mixture of $ZnCl_2$ and $As_2O_5$ gave good protection against the three termite species and (i) and (ii); i.e. failing only against *L. trabea*. At the same retentions, the other 4 preservatives tested—Cu $(BO_2)_2$, Cu chromate, chromated Cu arsenate ('greensalt') and copperized chromated $ZnCl_2$—were ineffective against both termites and fungi, though it is suggested that they would probably be effective at higher retentions. Corrosion tests with mild steel nails for a period of 12 months at $\ngtr$ 16% moisture content gave satisfactory results for plywood under normal interior and flooring conditions.

3780. JUSTO, A. D. Postes de madera preservados para alambrados. Una práctica y eficaz aplicación de las maderas de quebracho blanco y palo amarillo. **[Impregnated wooden fence posts. A practical and effective use for *Aspidosperma quebracho-blanco* and *A. vargasii*.]** *Bol. argent. for.* 18 (181), 1960 (7–8). [Span.]

A general discussion of the possibilities of using water-soluble salts for impregnating these species in Argentina. [Cf. *F.A.* 21 No. 2449.]

3781. **Self-sealing foam-rubber pole bandage.** *FAO For. Equipm. Note* No. *E*.20.59, 1959. pp. 2.

For use in after-treatment. Manufactured by AHIG-Holzschuzmittel, Dr. Wolman G.m.b.H., Sinzheim bei Baden-Baden, W. Germany.

3782. LINDGREN, R. M., and BLEW, J. O. **Wood preservation in housing and light construction.** [*Docum.*] *FAO Meeting on Wood Preservation, Rome 1959* No. *FAO/WT/59/P*-1, 1959. pp. [ii] + 24 + 4 photos. 14 refs. Limited distribution.

A general paper, with special reference to the situation in the U.S.A., discussing insect and fungal hazards, the use of treated wood for various purposes, existing or desirable standards, and regulations, research needs, etc.

3783. HUNT, R. W. **Wood preservatives as deterrents to drywood termites in the Southwest.** *J. econ. Ent.* 52 (6), 1959 (1211–2) 4 refs.

Tests and field observations in southern California indicate that the use of relatively small amounts of wood preservative is well worth the cost to house owners. Any one of the standard water-borne salts was satisfactory, but a Cu component is desirable. Treatment of cut ends, notches, and bored holes is important whatever the material or method used.

### 842. Treatments to Improve the Resistance of Wood to Physical and Chemical Agencies

See also Nos. 3636, 3739–40.

3784. STAMM, A. J., and BAECHLER, R. H. **Decay resistance and dimensional stability of five modified woods.** *For. Prod. J.* 10 (1), 1960 (22–6). 17 refs.

Describes tests in which small specimens of Sitka Spruce treated by (1) impregnation with a phenolic resin, (2) acetylation, (3) heat stabilization, (4) cross-linking with formaldehyde, and (5) bulking with polyethylene glycol, were subjected to soil-block culture tests with *Lenzites trabea*. All showed good resistance, decay inhibition being reached with swelling reductions of ca. 70% in (1) and (2), 40% in (3) and 50% in (4), and an 18% retention of the bulking agent in (5). Leaching with NaOH to remove formaldehyde with (4) and parallel agar tests with (5), indicated that no toxic effects were involved. Inhibition is explained by the prevention of sufficient water uptake to support decay, and by the removal in (2) and (3), and blocking in (1) and (4), of susceptible OH groups, so that decay enzymes cannot dissolve wood components [cf. *F.A.* 21 No. 2457].

3785. MITCHELL, H. L., and WAHLGREN, H. E. **New chemical treatment curbs shrink and swell of Walnut gunstocks.** *For. Prod. J.* 9 (12), 1959 (437–41). 1 ref.

Soaking green blanks for 39 days or shaped stocks for 24 days in a 30% aqueous solution of polyethylene glycol 1000 [cf. *F.A.* 21 Nos. 2456–7] made possible a shortening of kiln-drying time by ca. 14 days without degrade. Tests with shaped stocks in high- and low-humidity conditioning rooms showed greatly reduced values of dimensional change.

### 843. Fireproofing and Fire Resistance

See also Nos. 3769, 3772.

3786. GROSS, D. **Flame-spread measurements by the radiant panel flame-spread method.** *For. Prod. J.* 10 (1), 1960 (33–6).

Briefly discusses tests on solid wood, plywood, and composite boards, and of various fire-retardant coatings, by a surface flammability test developed by the U.S. National Bureau of Standards. The flame-spread index was greatly affected by m.c., sp. gr. and, in solid wood, surface structure, necessitating highly standardized conditions. All 8 retardants tested reduced the index compared with uncoated or conventionally coated material, intumescent water paint proving particularly effective.

3787. LAWSON, D. I. **Wood and fire research.** *J. Inst. Wood Sci.* No. 4, 1959 (3–13). 7 refs.

[Cf. *F.A.* 15 No. 1743.] Describes experiments on the ignition of wood and the propagation of fire by smouldering and flaming combustion, and discusses the value of surface protection in relation to the size of the compartment involved in fire. It is apparently impossible to make timber non-combustible, though various impregnation treatments and proprietary paints are examined that make wood very difficult to ignite and prevent its contributing to flame spread in the early stages of a fire. However, while appearing to be chemically stable, impregnation treatments are not satisfactory for outdoor use since they are affected by damp; fire-retardant paints cease to be effective when the burning contents of a building raise the general temperature to a point at which wood or wood products emit combustible gases. Details are also given [cf. *F.A.* 14 No. 639] on the particular problems of fire resistance in timber joist floors and roof trusses, the latter posing a problem that has yet to be solved economically; viz. how to insulate load-bearing timbers without greatly increasing their weight.

### 844. Attack by Plant Organisms

See also No. 3637.

### 844.1. Sap-staining and Mould Fungi

See also Nos. 3344, 3480, 3513, 3798, 3801, 3825.

3788. STUTZ, R. E. **Control of brown stains in Sugar Pine with sodium azide.** *For. Prod. J.* 9 (12), 1959 (459–63). 29 refs.

Discusses the nature of stains (enzymatic and bacterial) [cf. *F.A.* 21 No. 2503] from the literature and the author's own research. Laboratory and field experiments are described, as a result of which a dip of 0·5 lb. $NaN_3$ + 3–4 lb. $Na_2B_4O_7$ + 2–3 lb. $Na_2CO_3$/100 gal. water is recommended. The addition of ethyl mercury phosphate or Na PCP as bluestain inhibitors was found to have synergistic effects, and to allow a halving of the $NaN_3$ content, an advantage because of the evolution of $N_3H$ in 'sour' stock. No effect on stain already developed was observed. The dip will allow the use of faster kiln schedules.

3789. CAMPBELL; R. N. **Fungus sap-stains of hardwoods.** *Sth. Lumberm.* 199 (2489), 1959 (115–20). 20 refs.

In a study at Madison, *Ceratocystis piceae* (*a*) was isolated from stained Southern hardwoods in addition to species reported in earlier surveys. Of 24 infected samples, 20 also showed oxidation stains, usually extending from slightly below the surface towards the centre, with a distinct margin and of fairly uniform distribution and intensity. In infection tests on Sweetgum, *Endoconidiophora virescens* (*b*) produced heavy bluish-black staining in wood of 85 to 130% m.c., and *Diplodia natalensis* (*c*) on wood of 55–135%, whereas *C. pluriannulata* (*d*) produced only slight, and (*a*) no appreciable stain. In wood that had been previously air- or oven-dried, fungal growth was greatly retarded. Steaming made little difference. In tests on artificially inoculated Sweet-gum sticks, (*b*), (*c*), and (*d*) caused small (up to 5·2%) but significant reductions in modulus of rupture in 12–17 weeks, but only (*d*) a significant reduction (15%) in work to maximum load; only (*c*) significantly increased (by 20 to 25%) the amount of water absorbed during 15 min. submersion.

### 844.2. Wood-destroying Fungi

See also Nos. 2785, 3344, 3351–61, 3364, 3452, 3513, 3764, 3779, 3784, 3801, 3844.

3790. WAŻNY, J. Untersuchungen über die Einwirkungen von *Merulius lacrymans* Wulf. Fr. und *Coniophora cerebella* Pers. auf einige physikalische Eigenschaften befallenen Holzes. **[The effect of *M. lacrymans* and *C. cerebella* on some physical properties of wood.]** *Holz Roh- u. Werkstoff* 17 (11), 1959 (427–32). 7 refs. [G.g.e.] P.R.

[Cf. *F.A.* 20 No. 2498.] Weight, volume, and sp. gr. of wood decreased with duration of attack, though in some cases fungal attack at first produced a slight increase in volume. Sp. gr. was not very useful in determining the degree of decay. Sorption and swelling of Pine heartwood and Oak first decreased and then increased, whereas immediate increases were noted in Pine sapwood, Spruce, and Beech. Shrinkage was similar in all species. *C. cerebella* caused a greater change in the properties studied than did *M. lacrymans*. Resistance to attack, as measured by some of these properties, decreased in the order: Oak, Pine heartwood, Beech, Pine sapwood, Spruce.

3791. ÖHLMANN, J. Physikalische, Festigkeits und chemische Untersuchungen an Kiefernholz nach Befall durch den Kiefer-Baumschwamm. **[The physical, strength, and chemical properties of Pine wood infected by *Fomes pini*.]** *Arch. Forstw.* 8 (4), 1959 (361–71). 14 refs. [G.g.russ.e.]

Tests on heartwood blocks showing varying degrees of infection indicated that the rate of swelling and shrinking, particularly in the radial direction, increased with infection, even in slightly infected specimens equalling or exceeding that of sound sapwood. A linear relationship was found between loss of density and loss of strength in compression, but even in severely infected wood strength loss was $< 20\%$, and with slight or moderate infection it was negligible. Chemical analysis indicated that *F. pini* in the early stages attacked mainly lignin, but in the later stages the lignin/cellulose ratio did not change, suggesting that the fungus attacks both substances.

3792. **Natural durability trials.** *Extr.* from *Rep. Conserv. For. Ceylon 1958*, 1959 (64).

Natural durability trials by the wood-block method with *Polystictus sanguineus* as test fungus gave the following results in terms of average loss in % of dry weight after 18 months: *Diospyros ebenum* 1·95, *Mesua ferrea* 2·05, *Artocarpus heterophyllus* 3·97, *Filicium decipiens* 5·59, *Manilkara hexandra* 6·77, *Melia composita* 17·53, *Swietenia macrophylla* 39·56, *Michelia nilagerica* 44·43, *Doona zeylanica* 53·36.

3793. PURI, Y. N., SHARMA, R. P., and BAKSHI, B. K. **Toxic resistance of *Poria monticola* to copper and zinc in nutrient medium.** *J. sci. industr. Res. India* 18*C* (8), 1959 (149–52). 7 refs. P.O.

Three isolates of the fungus, from decayed wood, proved resistant to high concentrations of Cu and Zn, and can be employed as test fungi in the evaluation of wood preservatives.

3794. LAW, K. **A role of the laccase of wood-rotting fungi.** *Physiol. Plant., Copenhagen* 12 (4), 1959 (854–61). 10 refs. [E.e.]

The laccase of *Polystictus sanguineus* oxidizes a number of phenols in the lignin residue remaining after the action of certain fungi on wood. [Lignin was obtained from *Pinus sylvestris* decayed by *Merulius lacrymans* and from *Pinus contorta* decayed by *Poria monticola*.] The main lignin structure appeared to be unaltered after long periods of contact with laccase. Phenolic substances in sound wood are also oxidized. Observations on the fate of the oxidation products of guaiacol and catechol indicate that one of the roles of this laccase may be oxidation of phenolic substances for utilization by the fungi. [Cf. *F.A.* 18 No. 1059.] *From author's summary.*

3795. JURÁŠEK, L. Mikrostruktura borové běli při rozkladu celulosovorními houbami. **[Microstructure of *Pinus sylvestris* [sapwood] when attacked by brown rot fungi.]** *Drev. Výskum* 3 (2), 1958 (129–35 + 14 photos). 7 refs. [Cz.cz.russ.g.e.] P.R.

[Cf. *F.A.* 18 No. 4690.] *Poria vaporaria* and *Coniophora cerebella* caused almost the same changes in micro-structure, though *C. cerebella* took longer to achieve the same effect. The bars of Sanio, pit membranes of the medullary rays, and the torus in bordered pits, deteriorate very rapidly. From this it is concluded that these elements are of cellulose composition, as chemical tests confirm.

3796. DOŠEK, O. Ochrana bukovej gul'atiny nátermi. **[Protection of Beech logs by end coatings.]** *Drev. Výskum* 3 (2), 1958 (171–87). 20 refs. [Slovak.russ.g.e.] P.R.

Beech logs, cut in March and April, were end-coated 24 hr. later by brushing or spraying—in 1955 with 8 different preparations, and in 1956 with (1) Basileum Verstockungsschutz, (2) Emuldrin (*a*) undiluted and (*b*) diluted with 50% water, and (3) a tar anti-oxidant. The logs were later skidded and transported to a sawmill where they were stored in piles. In the 1956 experiments, by early July, untreated logs showed incipient decay to a depth of 32 cm., logs treated with (1) to 4·6 cm., with (2*b*) to 3·6 cm., and with (3) to 9 cm. Preparation (2*b*) is recommended for use in Czechoslovakian conditions.

### 845. Attack by Animals

See also No. 3637.

### 845.1. Marine Borers

3797. BOURDILLON, A. La dissémination des crustacés xylophages *Limnoria tripunctata* Menzies et *Chelura terebrans* Philippi. **[The distribution of the wood-destroying crustaceans, *L. tripunctata* and *C. terebrans*.]** *Ann. biol., Paris* 34 (11/12), 1958 (438–63 + 6 photos). 56 refs. [F.] O.R.S.

Includes a section on the factors inducing attack on wood, viz. the chemical composition of the wood, its hardness, colour (or more accurately, the amount of light reflected from it), and its roughness.

### 845.2. Terrestrial Borers

See also Nos. 2695–8, 3452, 3492, 3494, 3825.

3798. BUTOVITSCH, V. Bekämpande av blånadsspridande insekter i sommarlagrat virke. **[Control of insects spreading bluestain in wood stored during summer.]** *Skogen* 47 (5), 1960 (94–6). [Sw.]

Discusses various chemical and mechanical methods of control, and presents tabulated results of tests in which stacks of Pine logs were sprayed in 1958, before and after insect swarming. Satisfactory control was obtained with certain of the chemicals [composition not stated], viz. XY-GI, WI-3B, TI-VIIa and VIIIb and c, and with the Senior and Fontan knapsack sprays; application with the TIFA fogging machine gave less good results.

3799. JANNONE, G., and BINAGHI, G. Risultati di alcuni controlli fitosanitari su vegetali e prodotti vegetali esteri nel porto di Genova. I. Operazioni di scortecciamento e disinfezione di 10 tronchi di 'Douglas Fir' (*Pseudotsuga taxifolia* Britt.) dell' Oregon (USA), notizie su *Dendroctonus obesus* Mann. (Col., Scolytidae) in essi rinvenuto, e dati sull' importazione de legname grezzo attraverso il porto di Genova. **[Results of some phytopathological inspections of foreign plants and plant products in the port of Genoa. I. Barking and disinfestation of 10 logs of Douglas Fir from Oregon, notes on *D. obesus* found on them, and data on imports of logs via the port of Genoa.]** *Ann. Sper. agr.* (*n.s.*) 13 (6), 1959 (lvii–lxxxv). 18 refs. [It.it.e.] C.G.B.

3800. BECKER, W. B., and ABBOTT, H. G. **Lumber downgrading losses due to insect damage to small unseasoned Pine sawlogs.** *J. For.* 58 (1), 1960 (46–7). 5 refs.

In early spring 1955, logs sawn from windthrown *Pinus strobus* at Pembroke, Mass., were left scattered in the woods. A BHC emulsifiable liquid diluted in water to 0·4% $\gamma$ isomer content was used to spray 40 logs containing 1006 bd. ft. in April and another 40 containing 1219 bd. ft. in May; 40 logs containing 904 bd. ft. were left unsprayed. In November all test logs were sawn into boards 1 in. thick and then graded. In unsprayed logs of all diameter classes used (11 in. maximum) holes caused by Cerambycidae, particularly *Monochamus scutellatus*, commonly penetrated to or near the centre of the xylem. Holes of *Gnathotrichus materiarius* did not penetrate more than 2 in. Of the total volume downgraded because of insect damage, 64% was attributed to large worm holes and 36% to pinworm holes. The two groups of sprayed logs were entirely free from worms: their value was $112.49 and $126.58 per 1000 bd. ft. respectively. Lumber from unsprayed logs would have been worth $108.89 per 1000 bd. ft., but insect damage downgraded it to $70.56, a loss of $38.33 or 35.2%. Losses for downgrading higher-quality timber would be greater.

3801. DAMOISEAU, R. De la protection des bois de grumes et des sciages frais. **[The preservation of logs and freshly sawn wood.]** *Bull. Inform. Inst. Nat. Étude Agron. Congo Belge* 8 (4), 1959 (239–47). 2 refs. [F.]

Reports on 3 studies started in 1955 at Yangambi, Belgian Congo. Tables are given, classifying species according to their susceptibility to borer and barkbeetle attack as: (1) very susceptible: sapwood invaded in < 24 hours and heartwood deeply penetrated (9 spp.); (2) moderately susceptible (20 spp.); (3) resistant (15 spp.). Recommendations are given for reducing the risk of beetle or fungus attack during felling, extraction, sawing, and storage. It was found that the application by back-pack sprayer of a mixture containing 2% of a wettable powder (12% $\gamma$BHC) plus a sticker, at 0·1% concentration, using 500 c.c./sq. m., prevented loss in the forest for 12–15 days. If the stems can be freed of surrounding brush and bark epiphytes, immediate treatment on the felling site is desirable, at least for (1), before they become muddy through handling. In the timberyard, an aqueous spray of BHC will protect logs for up to one month; for longer protection, a combined insecticide/fungicide is used at intervals. A mixture of two wettable powders (BHC and Na PCP) at 20% concentration in water gave logs of *Scorodophloeus zenkeri* total immunity for 2 months. A compound containing BHC and chlorophenols as active principles proved effective for 4 months on *Oxystigma oxyphyllum*. Employed pure or with 25% of fuel-oil added, it possesses marked water-repellent properties, so that it resists rain for several months and is not washed away by sap exudation. Its cost and the dosage required (400–500 c.c./sq. m.) restrict its use to painting sectional surfaces in order to check surface drying and to avoid cracking. It might be used to give complete protection to logs being floated. Experiments on the treatment of wood directly after sawing were carried out on 11 species particularly susceptible to fungus and insect attack: *Oxystigma oxyphyllum*, *Albizzia adianthifolia*, *Celtis mildbraedii*, *Antiaris welwitschii*, *Gossweilerodendron balsamiferum*, *Alstonia boonei*, *Brachystegia laurentii*, *Fagara macrophylla*, *Drypetes gossweileri*, *Scorodophloeus zenkeri*, and *Pycnanthus angolensis*. The preservative used was a mixture of an emulsifiable solution of 1% $\gamma$BHC and a wettable powder with Na PCP and a borax base at 4% concentration. After a single spray wetting their surface, all specimens were undamaged by insects a year later, with the exception of the sapwood of *O. oxyphyllum* and *B. laurentii*, for which a 10-min. dip is recommended. Of the controls used, only *S. zenkeri* (heartwood and sapwood), *G. balsamiferum* (h.w.), and *F. macrophylla* (h.w.) remained practically undamaged.

Sapstain appeared only in *B. laurentii*; this was attributed to a delay in treatment of 24–48 hours. None of the treated specimens suffered from rot, though controls were colonized (by *Polystictus sanguineus*, species of Xylariaceae, etc.). Precautions for the safety of workers handling toxic substances are listed.

3802. ROONWAL, M. L., CHATTERJEE, P. N., and THAPA, R. S. **Results of laboratory and field experiments on protection of Bamboos in storage against *ghoon* beetles, *Dinoderus* spp. (Coleoptera: Bostrychidae).** *Indian For. Bull.* (*n.s.*) No. 216, 1958 (1959). pp. 32 + 5 photos. 10 refs. Price *Rs*.3.62 (5*s*. 9*d*.).

Gives the results of experiments in 1950–54 on prophylactic treatment of stored bamboos. Laboratory experiments were carried out on *Bambusa nutans* and *Dendrocalamus strictus*, large-scale experiments on *D. strictus* alone. In the laboratory, almost complete protection for one year was given by spraying with 0·33, 0·5, and 1% γBHC in kerosene oil, and 5% DDT in kerosene oil. In the large-scale experiment, several insecticides were sprayed on the outside of large bamboo stacks containing up to 1900 culms each; the centre of the stack was not directly sprayed, but some insecticide reached it by dripping from above. The treatments here were: (i) γBHC 0·24% in kerosene/soap emulsion; (ii) γBHC 0·35 and 0·5% in water suspension; (iii) DDT 7% in kerosene; (iv) DDT 10% in water suspension or emulsion; (*v*) 'Dieldrex 18', ¼ oz. in 2 and 3½ gal. water; (vi) 'Aldrex 14', ½ oz. in 2 gal. and 1 oz. in 5 gal. water. Almost complete protection was given by (ii) at 0·5%, (iii), (iv) and (v), and 90% protection by (vi). In some cases where initial attack had previously occurred, a considerable degree of control was effected by (ii) and (vi). Approximate costs per stack of 2000 culms were Rs.–/12/– for (v) and (vi) vs. Rs.4 to 8 for (ii), (iii) and (iv).

3803. JOLY, R. Additions à la faune des xylophages du noyer. **[Additions to the wood-borer fauna on Walnut.]** *Rev. for. franç.* 12 (1), 1960 (35–43). 9 refs. [F.]

Describes, by families, known and newly discovered pests of the order Coleoptera. The list of Cerambycidae includes 6 species not previously noted for Walnut. Suggestions for wood protection are given.

3804. ST. GEORGE, R. A., and MCINTYRE, T. **Powder-post beetles in buildings: what to do about them.** *Leafl. U.S. Dep. Agric.* No. 358, 1959. pp. 8.

3805. BLETCHLY, J. D. **Studying the [development of the] eggs of *Lyctus brunneus*.** *Timb. Technol.* 68 (2247), 1960 (29, 31). 10 refs.

Describes a time-saving technique in which veneers 150μ or 200μ thick are used, instead of solid blocks.

### 845.3. Termites

See Nos. 3779, 3783.

### 847. Drying (Seasoning)

See also Nos. 3631, 3637, 3770, 3829.

3806. GAVIÑA MÚJICA, M. Secado de la madera. I. **[The drying of wood. I.]** Servicio de la Madera, Ministerios de Industria y Agricultura, Madrid. 1959. pp. 126. [Span.]

A general study of the principles of air- and artificial drying of hardwoods and softwoods, including chapters on the microscopic structure and the density of wood, the phenomena of sorption and desorption, hysteresis, swelling and shrinkage, and moisture circulation and distribution. The final chapter examines the various defects produced in wood by bad or incorrect seasoning methods.

3807. OGURA, T. **[Studies on the mechanism of drying of wood (7). On computing the time required to dry wood by using the moisture conductivity.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 117, 1959 (122–63). 18 refs. [Jap.e.*e*.]

Discusses the effects of drying conditions on moisture conductivity (*K*) and diffusion coefficient (λ), and the possibility of practical application of suitable values of *K* to solve the diffusion equation for calculating the time required to season wood of given species, dimensions, etc. [Cf. *F.A.* 14 No. 2835.]

3808. TARAS, M. A., and HUDSON, M. **Seasoning and preservative treatment of Hickory crossties.** *Hickory Task Force Rep. Stheast. For. Exp. Sta.* No. 8, 1959. pp. 24.

The studies reported showed that Hickory sleepers can be dried to a m.c. between 20 and 40% with minimum degrade by: (1) air drying for 6–12 months; (2) controlled air seasoning for 11 days: (3) kiln drying for 3–5 days; (4) vapour drying for 14 hours. A review of experience to date showed that preservative treatment of Hickory is possible, though sometimes difficult, incising improving uniformity of penetration, and that on its service-tests record, Hickory is as good as preferred sleeper species. *From authors' summary.*

3809. VILLIÈRE, A. Le séchage de l'ilomba. **[The seasoning of *Pycnanthus angolensis*.]** *Bois For. Trop.* No. 68, 1959 (31–8). [F.e.span.]

Tests have been made at the Centre Technique du Bois on boards 27 and 54 mm. thick, both in the open air and in low- and high-temperature kilns. Collapse occurred in all cases. Air drying followed by steaming is recommended for this species in the tropics.

3810. CLARK, W. P., and HEADLEE, T. M. **It pays to roof your lumber.** *Sth. Lumberm.* 200 (2492), 1960 (39–40, 44).

Reports results of roofing box-stacked 1-in. Red Oak and Yellow Poplar boards in S. Illinois. The Oak boards dried faster and more uniformly, with less degrade, than when unroofed; the Yellow Poplar dried at a more constant rate and with less degrade. The profitability of roofing is worked out for the different grades of lumber.

3811. Smith, H. H., and Berolzheimer, C. P. **Air drying of Incense-Cedar [*Libocedrus decurrens*]: Tests under winter conditions in California.** *Tech. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 38, 1959. pp. 13. 6 refs.

The winter seasoning of *L. decurrens* was studied in the period Oct. 1956–Oct. 1957 using random-width, 3-in.-thick planks, and 3 × 4-in. sawmill 'squares' of sapwood (s.w.), light heartwood (l.h.w.), and heavy heartwood (h.h.w.). Width of material, stack spacing and position in the stack had no appreciable effect on drying rate or final m.c. Wide planks checked twice as much as the squares, the greatest incidence of checking occurring on the tangential faces of the wider h.h.w. planks. S.w. and l.h.w. samples dried to a uniform final m.c. of 15% in 7½ months, whereas h.h.w. samples took 11 months. M.c., however, was not uniform throughout the cross-section of individual samples or as between samples, and the final m.c. of h.h.w. was greatly affected by its initial m.c. Comparing the present results with tests on drying *Sequoia sempervirens* under more humid conditions [cf. *F.A.* 15 No. 3014], it is observed that drying 3-in.-thick *L. decurrens* in a drier climate is not limited by the capacity of air to remove moisture, but by the rate of diffusion of the moisture from the interior to the surface of the pieces.

3812. **The treatment of timber in a drying-kiln.** *Leafl. For. Prod. Res., Lond.* No. 20 (rev.) 1957. pp. 8.

[Cf. *F.A.* 17 No. 2164.] Mentions changes in kiln-drying schedules.

3813. Korger, M., and Viktorin, Z. Stanovení vysoušecích postupů pro měkké řezivo. **[Determination of drying schedules for softwood lumber.]** *Drev. Výskum* 4 (2), 1959 (223–50). 20 refs. [Cz.russ.g.e.] P.R.

An account of German and Russian literature, and of Czechoslovakian comparative experiments designed to resolve some of the differences apparent in the literature and to make general relationships clear. Schedules for sawn softwood lumber have been determined.

3814. Bryan, E. L. **Kiln drying of 4/4 Pacific Madrone [*Arbutus menziesii*].** *Calif. For. & For. Prod. Calif. For. Prod. Lab.* No. 15, 1959. pp. 5. 6 refs.

3815. Brown, W. H. **Aspects of timber seasoning. Properties of the genus *Entandrophragma*.** *Timb. Technol.* 68 (2249), 1960 (108, 115).

Discusses kiln seasoning (mentioning defects, shrinkage, etc.), and also subsequent conversion of *E. cylindricum*, *E. angolense* and *E. utile*.

3816. Lund, A. E., and Taras, M. A. **Kiln drying chemically treated Scarlet Oak and White Oak lumber.** *For. Prod. J.* 9 (11), 1959 (398–403). 8 refs.

Describes tests with a commercial salt containing a corrosion inhibitor and severe kiln schedules, already briefly described [see *F.A.* 18 No. 4728]. Tests showed a considerable reduction in the % of honeycombing, but only ca. 50% of treated boards were free from it. This and the severe kiln corrosion due to the chemical probably make the method impracticable commercially.

3817. Ellwood, E. L. **Kiln drying green 4/4 California Black Oak [*Quercus kelloggii*].** *Calif. For. & For. Prod. Calif. For. Prod. Lab.* No. 17, 1959. pp. [8]. 3 refs.

Tests were made with two schedules, and observations made on degree of checking, warp, shrinkage and collapse. With the milder schedule, green Black Oak could be dried to 8% in 25 days (including equalizing and reconditioning). But as degrade in the best qualities was rather severe, it is recommended that mill boards be either reconditioned after, or air dried before, kiln drying. [Cf. *F.A.* 20 Nos. 3877, 5300.]

3818. Ellwood, E. L., Ecklund, B. A., and Zavarin, E. **Collapse in wood . . . exploratory experiments in its prevention [with discussion].** *For. Prod. J.* 10 (1), 1960 (8–21).

Reviews theories of collapse and describes investigations to test the theory that liquid surface-tension is the dominating cause. The moisture in green hardwoods was replaced by various organic liquids (including a series of alcohols, solutions of acetic acid, $CH_3COOH$, and of $ZnCl_2$, and polyethylene glycol) to essential saturation before drying in severe conditions. Some treatments resulted in freedom from defects where the controls had collapsed severely (heartwood of *Quercus kelloggii*, *Arbutus menziesii* and *Lithocarpus densiflorus* being chosen for their tendency to collapse). Best results were obtained with ethylene glycol monoethyl ether, methanol, and ethanol. Though the reduction of collapse obtained with liquids of comparatively low surface tension supported the theory, reduction was more than would be expected from this cause alone, and there were indications that modified elasticity and plasticity of the cell-walls were responsible for some of the anti-shrink effects observed. Tensile compressive stresses during drying were also reduced.

3819. Boye, C. Undersøgelse over mulighederne for anvendelse af højfrekvensenergi, H.F., (dielektrisk opvarmning) indenfor træindustrien. Foreløbig beretning nr. 1: Forsøg med bøjning og tørring av massive mindre ege- og bøgeemner. **[The use of high-frequency (dielectric heating) in the wood industry. Preliminary report 1: bending and drying small solid Oak and Beech blanks.]** *Træindustrien* 9 (12), 1959 (147–51). 5 refs. [Dan.] P.R.

Solid Oak (1⅝ × 1⅝ × 22½ in.) could not be dried by dielectric heating without splitting, and bending tests were therefore not made. Round pieces of Beech (diam. 28 mm., length 59 cm.) were successfully dried; initial bending pressure should be 60 kg., increasing to 80 kg. Further studies will be made.

3820. Migačev, A. I. Centrobežnaja sušilka dlja drevesiny. **[A centrifugal kiln for wood.]** *Derev. Prom.* 8 (4), 1959 (26). [Russ.] P.R.

[Cf. *F.A.* 15 Nos. 2009–11.] Describes, with diagrams, a centrifugal kiln consisting essentially of a rotating platform on which the sawn timber is placed, the platform being electrically driven.

The heater is at the top of the kiln, the heating agent is steam, and a continuous exchange of air occurs in the chamber. During drying, the platform rotates at 58–60 rev./min. The kiln takes 3–3·1 cu.m. of sawn timber, and actual drying 36–37 hr. Sawn softwood to the amount of 70 cu.m. has been dried in 4 months with excellent results. A larger kiln with a platform diameter of 5·5 m. has been designed, which will dry 15–16 cu.m. of sawn timber in 36–37 hr.

3821. Kruml, J. Účinek odstředivé síly na vlhkost dřeva. **[Influence of centrifugal force on the moisture content of wood.]** *Drev. Výskum* 4 (1), 1959 (47–69). 4 refs. [Cz.cz.russ.g.e.] P.R.

Presents a theoretical analysis of the effect of centrifugal force (c.f.) on wood m.c. and discusses laboratory centrifuge tests on its effect ∥, and ⊥ to the grain, both tangentially and radially to the rings of Beech, Oak, Spruce and Pine specimens (30 × 30 × 70–90 mm.). Tests were made at 20–25° C., for 15–30 min., at peripheral speeds of 5–45 m./sec. Results are graphed. Moisture removal (m.r.) was greatest in Beech, with c.f. ∥; even at 10 m./sec., m.r. reached almost its maximum value of 28% after 15 min. of centrifuging. M.r. was least when c.f acted radially. The shape of the moisture gradient curves did not depend on time and speed of rotation, but as both decreased, the position of the curves on the graph fell.

3822. Kruml, J. Vliv teploty, rychlost proudění a relativní vlhkosti vzduchu na úbytek vlhkosti při odstředivém sušení dřeva. **[Effect of temperature, air flow speed, and relative humidity on the moisture loss of wood in centrifugal drying.]** *Drev. Výskum* 4 (2), 1959 (209–21). 6 refs. [Cz.cz.russ.g.e.] P.R.

In centrifuge tests [see preceding abstr.] on green Beech, Spruce and Pine specimens (30 × 30 × 85–90 mm.) with centrifugal force (c.f.) ∥, increasing air and wood temperature and air speed increased the rate of moisture removal (m.r.), while increased r.h. reduced it. None of these factors affected m.r. in the first phase of the tests, when part of the free moisture was being removed in a liquid state. Drying rate curves here are infinite, and indicate the limits of moisture removed as liquid by a given c.f. In the range of free moisture below this limit, the direct effect of c.f. (i.e. removal of moisture as liquid, and the generation of moisture movement within the wood) disappears and the effect of drying factors increases. Removal of hygroscopic moisture depends exclusively on drying factors. Here the effect of air speed depends on the amount of moisture moving from the middle of the specimen to the evaporation surface.

### 848. Timberyard Practice. Handling and Storage of Timber

See also Nos. 3246, 3796, 3810.

3823. Soiné, H. Das Förderwesen in der Holzindustrie: Zweite Mitteilung: Gleislose Flurfördermittel—Mobil- und Autokrane. **[Transport in the wood industry. II: Trackless transport—mobile and lorry-mounted cranes.]** *Holz Roh- u. Werkstoff* 17 (11), 1959 (447–51). 2 refs. [G.g.e.] P.R.

[Cf. *F.A.* 21 No. 1146.] Describes some characteristic models, and discusses their uses.

3824. Soiné, H. Das Förderwesen in der Holzindustrie: dritte Mitteilung: Gleislose Flurfördermittel—Werkschlepper, Sonder- und Kleingeräte, Paletten. **[Transport systems in the woodworking industry. III. Trackless transport—tractors, special and small equipment, pallets.]** *Holz Roh- u. Werkstoff* 18 (1), 1960 (25–31). [G.g.e.] P.R.

[Cf. *F.A.* 21 No. 1146.] Mainly of German manufacture.

3825. Burmester. Rundholzschutz gegen Risse, Bläue und Insekten. **[Protecting roundwood against checks, bluestain and insects.]** *Holz-Zbl.* 85 (154/155), 1959 (2067–8). [G.]

Spruce and Pine logs, stacked unbarked, were protected against degrade for 230 days by sprinkling with ca. 6 litres water/sq.m./hr. Chemically treated controls had severe bluestain, and untreated controls both stain and barkbeetle damage.

## 85. Grading of Wood and Wood Products

### 851. Timber Quality in General

See Nos. 3149, 3158, 3720–9, 3753.

### 852. Detection, Recognition and Assessment of Injuries and Defects

See also Nos. 3672, 3674, 3690, 3714, 3761–3, 3817–8.

3826. Perem, E. **The effect of compression-wood on the mechanical properties of White Spruce and Red Pine.** *F.P.L. tech. Note For. Prod. Lab., Can.* No. 13, 1960. pp. 22. 8 refs.

Specimens of *Picea glauca* and *Pinus resinosa* were classified on the basis of a method distinguishing 3 types of compression-wood (c.-w.); (*a*) slight, i.e. annual rings only slightly more accentuated than in normal wood (n.w.); (*b*) intermediate, i.e. the forms of c.-w. are more readily recognizable through the presence of a greater than normal amount of apparent summerwood; (*c*) pronounced, i.e. the apparent summerwood occupies 50% of the width of the annual rings. Compression ∥, static bending, and toughness were tested on green and air-dry test samples. A comparison of the strength properties of c.-w. and n.w. indicated that the structural organization of c.w. is inferior to that of n.w. as regards resistance to mechanical stresses, even type (*a*) tending to lower the specific strength (strength per unit of weight), which generally decreases with the increasing completeness of c.-w. development, though this unfavourable effect is somewhat offset by the cell-walls of c.-w. being less saturated than those of n.w. Tests indicated the following differences between the properties of n.w. and the types of c.-w. described: (1) Both maximum crushing and maximum bending strength of c.-w. were higher in green condition, but in air-dry condition roughly the same as for n.w. (2) Specific strength in compression ∥ was similar in green condition, but lower for c.-w. in air-dry condition. (3) Specific bending strength was lower for c.-w., especially in air-dry condition. (4) Toughness of green c.-w. was higher than that of green n.w., but lower for c.-w. in air-dry condition; specific toughness of green c.-w. and n.w. was about equal, but in air-dry condition considerably lower for c.-w.

3827. LENZ, O., and STRÄSSLER, H. S. Contribution à l'étude de l'éclatement des billes de hêtre (*Fagus silvatica* L.). **[Splitting in Beech logs.]** *Mitt. Schweiz. Anst. Forstl. Versuchsw.* 35 (5), 1959 (369–411 + 5 plates, 2 dgms.). 35 refs. [F.f.g.it.e.]

Detailed measurement of growth stresses [cf. M. R. Jacobs, *F.A.* 1, p. 44; 8 No. 308], of physical properties and anatomical structure, were made on 6 winter-felled stems from sites with (*a*) a good, and 6 from sites with (*b*) a bad, reputation as regards splitting. All were well formed, 40–48 cm. in d.b.h., 24–36 m. high, aged 62–146 years. Longitudinal stresses ascertained as a function of the modulus of elasticity, and strains (deformation) immediately after felling, again after removal of the crown, and after further cross-cutting, and also in a board cut from the centre of the second log after longitudinal and transverse cuts, were markedly greater in (*b*) than in (*a*) stems. Mean elongation of the stem after felling and crown removal was 0·02% for the 2 best, and 0·08% for the 4 worst stems. No clear relation could be found between splitting tendency, and size or form of crown, lean of stem, or slope of ground, or density and moisture content or their distribution in the stem. But the worst splitters contained the most tension wood, which was generally situated right round the stem in the zone of longitudinal stresses. It is noteworthy that the worst splitter, with the greatest % of tension wood, was a perfectly straight and vertical stem. The (*b*) sites, which produced the worst stems, were at higher altitudes than the (*a*), and hence produced slower growing trees, but within each site there was no correlation with age. In view of the very high stresses involved (greater than those reported by Jacobs and Kübler [cf. *F.A.* 21 No. 2368], the scope for preventive measures is limited.

3828. WELLNER, C. A. **Devices to measure spiral grain and twisting in poles.** *J. For.* 58 (2), 1960 (117–8).

Describes the 'bolaxis' an instrument consisting of two pairs of rigid legs designed to straddle logs, poles, or trees, connected by a bar ca. 24 in. long and each pair bisected by a sharp pointer movable in a plane || to the other. A strip of bark is removed, a scratch made along the grain and the pointers of the bolaxis are adjusted to the scratch. The deviation between them can be calibrated either in degrees or inches for the distance between the pointers. A device for measuring angular twisting in vertical poles is also described. A 6-ft. horizontal arm is attached to the top of the pole, and a mark made on a permanent rail at the point indicated by a plumb-line suspended from the tip. Subsequent twisting is measured at the point where a rod running from the centre of the pole and directly beneath the plumb-line crosses a graduated scale in the form of a segment of a circle, which can be attached to the base of the pole by hook and eye, and is so placed that each degree represents 1 in.

3829. KLOOT, N. H., and PAGE, M. W. **A study of distortion in Radiata Pine scantlings.** *Div. For. Prod. technol. Pap. For. Prod. Aust.* (*n.s.*) No. 7, 1959. pp. 24. 2 refs.

Measurements of bow, spring and twist made on ca. 600 scantlings of 2 × 4- and 3 × 2-in. cross-section, cut from 30 trees, indicated less distortion in (*a*) scantlings cut from dry flitches than in (*b*) those cut green from the log and then dried. The significant decrease in the amount of distortion during 12 months' storage after drying was ascribed to a gradual elimination of moisture gradients within the sections. The 3 types of distortion are greatest in the pith region, and consideration was therefore given to sawing patterns that might lead to maximum recovery of acceptable material. However, even by eliminating pith-containing material, the % of (*b*) rejected under current [Australian] grading rules is very high, a much higher % of acceptable pieces being obtained from (*a*). In flitches of high width/thickness ratio, less twist occurs than in those whose width/thickness ratio approached unity. Indirectly, the data indicate that the control of drying of this type of material may significantly affect the amount of distortion produced, and investigations of this aspect are recommended. *From authors' summary.*

### 853. Grading of Wood in the Rough

See also Nos. 3543–4, 3546, 3605, 3760.

3830. REID, J. S. **Utilisation of the Beech timbers.** *N.Z. J. For.* 8 (1), 1959 (101–8).

Stresses the importance of research into the particular qualities of *Nothofagus* spp., and the introduction of specific grading rules taking account of local variations in density, the modification of seasoning schedules, and trials for critical uses.

3831. WOLLIN, A. C., and VAUGHAN, C. L. **Hardwood log grades for standard lumber. Proposed methods and results.** *Rep. U.S. For. Prod. Lab., Madison* No. 1737, 1959. pp. 15 + 48 tbls. + 3 drawings.

Presents a system of grading hardwood logs for sawing into standard factory timber, to meet the need for a method of determining the money values realizable when a given lot of logs is sawn into standard timber. Visible surface characteristics of logs are correlated with the proportions of high-, medium- and low-grade timber that the log will yield. A description of methods of field study and analysis is given.

3832. PUTNAM, J. A. **Basic differences in grading hardwood and softwood sawtimber.** *Proc. Soc. Amer. For. 1959*, 1960 (57–62).

Contrasts systems of grading softwood logs, generally adapted for a single end-product, and hardwoods, with their greatly varied and alternative uses. A possible division of hardwood logs into 11 use-classes is presented. This would permit more complete realization of the value of the timber, and ensure that it was put to the most appropriate use.

### 854. Grading of Converted Timber

See also Nos. 3637, 3682, 3760, 3768, 3800, 3830.

3833. **Asia-Pacific regional grading rules for sawn hardwood timber (nonteak).** FAO, Rome. 1959. pp. 83.

3834. **The Malayan grading rules for sawn hardwood timber.** Forest Department, Malaya. Rev. ed. 1960. pp. 85. 1 set of drawings. Price $2.

[Cf. *F.A.* 16 No. 4740.] Includes a new section on stress grading.

## 86. Pulp Industries. Composite Materials made Wholly or Partly of Woody Matter. Chemical Utilization of Wood

See also No. 3631.

### 861. Pulp and Paper Manufacture. Textile and Other Cellulose Derivatives

See also Nos. 3627–30, 3638, 3664, 3878.

3835. **The development of pulp and particle board industries and their effect on forest management with special reference to the Sandwell Reports. Report of discussion held at Lyndhurst, November 1959.** *Suppl.* to *Forestry.* Oxford University Press, London. 1960. pp. 68. Price 5*s.*

[Cf. *F.A.* 20 No. 5069; 21 No. 2534.] Contains the following papers, with reports of discussion: (I) Views of industrialists: The development of the wood pulp industry (*T. H. Frankel*); The development of the chipboard industry (*F. C. Lynam*); (II) Views of technologists: Anatomical criteria for industrial use (*B. J. Rendle*); The 'juvenile' period (*L. Chalk*); (III) Views of competitors for the raw material: Requirements for the coal-mining industry (*B. C. Hollingsworth*); Requirements for the furniture industry (*J. P. Pritchard*); Requirements for housing and packing (*S. E. Wilson*); (IV) Forest management considerations: Forest management in relation to the pulp and board mill industries (*G. B. Ryle*); (V) The economist's evaluation: Small-scale pulping in the United Kingdom (*G. W. Troup*); (VI) Summary (*N. K. Rankin*).

3836. **Three-way partnership seeks solutions to pulp and paper research problems.** *Analyt. Chem.* 32 (2), 1960 (121*A*–123*A*). O.R.S.

A brief illustrated description of the Pulp and Paper Research Institute of Canada (PPRI) at Pointe Claire, near Montreal. PPRI, in which the Canadian government, the Canadian Pulp and Paper Association and McGill University are associated, is primarily for fundamental research, but also serves as a clearing-house for technical and scientific data.

3837. Beničák, J. Kontrola rozvláknenia bukového dreva sitovým rozborom za sucha. **[Control of Beech defibration by sieve analysis under dry conditions.]** *Drev. Výskum* 3 (2), 1958 (207–22 + 1 plate). 5 refs. [Slovak.russ.g.e.] P.R.

Describes the results of tests, which showed the possibility of (1) grading Beech fibres in the dry state on sieves, and (2) using sieve-analysis evaluations to express the degree of defibration numerically. A set of sieves of mesh sizes 2 × 2, 1 × 1, 0·5 × 0·5, 0·25 × 0·25, and 0·10 × 0·10 mm. was found to be suitable.

3838. Kubínek, V., and Šedivý, M. Studium obsahu a vlastností buničiny z lesního odpadu. **[Study of the pulp content of forest waste, and its properties.]** *Drev. Výskum* 4 (2), 1959 (191–208). 6 refs. [Cz.cz.russ.g.e.] P.R.

Sulphate pulps were made of clean unbarked branches (3–7 cm. diam. at thick end) of Spruce, Pine, Hornbeam and Beech. Yields were ca. 40%, and, with the exception of Beech pulps, strengths proved satisfactory, being almost as high as those of pulps from normal pulpwood. Beech should be used only as an admixture (≯ 20%). The chief drawback in using branchwood is the cost of the chips—50–100% more than normal, per unit of volume.

3839. Doyle, J. A., and Bell, G. E. **Progress in the use of sawmill residue for pulp in Eastern Canada.** *Emp. For. Rev.* 39 (1), 1960 (61–7).

Notes on the vast increase in the last decade in the utilization of sawmill residue in Canada, where > 1½ million cords, or > $\frac{1}{10}$ of total Canadian pulp mill requirements, are made into pulp yearly. Recent developments have centred on the production of smaller and more economic barkers and chippers suitable for E. Canadian conditions. Some of these machines are illustrated.

3840. Istas, J. R., Raekelboom, E. L., and Heremans, R. Étude de quelques bois congolais. **[Some timbers from the Belgian Congo.]** *Publ. Inst. Nat. Étude Agron. Congo Belge* (*Sér. tech.*) No. 59, 1959. pp. 183. 43 refs. [F.] Price *Fr.*100.

Gives detailed test data on fibre dimensions and character, chemical analysis, cooking schedules, and pulp and paper properties for the following timbers: *Alstonia boonei, Beilschmiedia congolana, Brachystegia laurentii, Celtis brieyi, C. mildbraedii, Chrysophyllum africanum, Combretodendron macrocarpum, Copaifera mildbraedii, Cynometra alexandri, Dialium corbisieri, Drypetes gossweileri, Entandrophragma angolense, E. candollei, E. cylindricum, Fagara macrophylla, Fillaeopsis discophora, Gilbertiodendron dewevrei, Gossweilerodendron balsamiferum, Guarea cedrata, Hannoa klaineana, Irvingia gabonensis, Millettia laurentii, Panda oleosa, Parinari glabra, Pentaclethra macrophylla, Piptadenia africana, Polyalthia suaveolens, Sarcocephalus diderrichii, Scorodophloeus zenkeri, Staudtia gabonensis, Strombosia glaucescens, Strombosiopsis tetrandra, Tessmannia lescrauwaetii, Tridesmostemon claessensii.*

3841. Istas, J. R., and Raekelboom, E. L. Étude chimique, biométrique et papetière du bois de cinq essences feuillues à croissance rapide. **[Study of the chemical, biometrical and paper-making characteristics of the wood of five fast-growing broad-leaved species.]** *Bull. agric. Congo belge* 50 (4), 1959 (1037–51). 16 refs. [F.f.du.]

*Cecropia leucocoma, Ceiba pentandra, Melia bombolo, Albizia chinensis* (*Albizzia stipulata*), and *Eucalyptus grandis* were examined, using samples from stated sources, and pulped by the soda process, The density of wood, fibre dimensions, and details of pulping are tabulated, for each species, with a description of specimen sheets of paper. *A. chinensis* and *C. pentandra* [cf. *F.A.* 9 No. 2407] do not appear suitable for the production of chemical pulp. At 18 years *E. grandis* gave a pulp comparable with that of other Eucalypts, though inferior to that of *E. globulus*. It appears desirable to use Eucalypts > 10 years old to produce good chemical pulp. No conclusion was reached for *M. bombolo* or *C. leucocoma*; though unsuitable for pulps where mechanical strength is demanded, they may prove useful in the production of bleached or semi-chemical pulp, but further samples 10–15 years old need to be examined.

3842. ISTAS, J. R., and RAEKELBOOM, E. L. L'addition de fibres longues aux pâtes écrues de bois d'essences feuillues congolaises. **[The addition of long fibres to unbleached pulps from [Belgian] Congo hardwoods.]** *Bull. agric. Congo belge* 50 (5), 1959 (1375–86). 1 ref. [F.f.du.]

Tabulated results show that some characteristics of paper made from short-fibred pulp (*Musanga cecropioides* and *Melia bombolo*) can be improved by the addition of a proportion of pulp with long fibres (*Bambusa vulgaris*, *Strombosia glaucescens*, and *Pinus sylvestris*). The addition of a small % of glass fibre to pulps of *M. bombolo* and *M. cecropioides* appeared to increase tearing strength without detriment to other qualities.

3843. PALAZZO, F. C. **The manufacture of semi-chemical pulp for paper and board by means of volatile and recoverable reagents.** [*Docum.*] *8th Sess. FAO Tech. Panel Wood Chem., Wiesbaden 1959*, No. *FAO/WCP*/59, 1959. pp. 3. Limited distribution.

The method proposed involves soaking finely comminuted chips in a 3–4% $NH_3$ solution for 1–2 hours and then heating them in a digester with a 2·5–3% solution of $SO_2$ in water to 105–108° C. for 1 hr. The $SO_2$ and, if it is used after instead of before the hydrolysis, the $NH_3$ also, can be completely recovered at low cost. Pulp so produced from light hardwoods is claimed to equal in yield and quality that made by the neutral sulphite semi-chemical process.

3844. WILSON, J. W., WORSTER, H., and O'MEARA, D. **The sulphate pulping of some south central British Columbia wood species.** *Pulp Paper Mag. Can.* 61 (1), 1960 (19–24). 15 refs.

Western Hemlock, Balsam, Engelmann Spruce, Douglas Fir and Western Red Cedar, and a mixture of the first 4 species, were evaluated in terms of wood quality, pulping characteristics and raw pulp properties. Comparison with other data showed that these woods had a high sp. gr. and gave unusually good sulphate pulps. Western Hemlock and Balsam gave the highest pulp yields. The presence of decay, investigated in Hemlock and Balsam, resulted in faster pulping, reduced pulp yield and reduced strength. *Fomes pinicola* (a brown rot) was the most harmful, white rots being less so. Usable pulp fibre was, however, obtained in all cases from wood attacked (advanced, moderate or incipient decay) by *F. pinicola*, *Omphalia campanella*, *Echinodontium tinctorium*, *Odontia bicolor*, and *Stereum* spp.

## 862. Composite Materials made Wholly or Partly of Woody Matter

See also Nos. 3626, 3735–6, 3739–40, 3755, 3770–1 3835.

3845. SUCHSLAND, O. **An analysis of the particle board process.** *Quart. Bull. Mich. Agric. Exp. Sta.* 42 (2), 1959 (350–72).

Employing the model of a veneer laminate, the characteristics of a mat of particles were expressed in terms of a binomial distribution of the sums of particle thicknesses over any area element. The results obtained from the model were verified by compression tests on Elm flake mats and bending tests on Elm flake boards. The relative compression area of a flake mat—a function of particle geometry and compression ratio—seems to be the significant factor determining the bending strength of a flake board. The preparation of flakes by a 2-step reduction method proved to be inadequate. The design of 3-layer boards is discussed. *From author's summary.*

3846. KUMAR, V. B. Die statistische Qualitätskontrolle in der Spanplattenindustrie—Erste Mitteilung: Holzzerspaner. **[Statistical quality control in the particle board industry. I. Wood chippers.]** *Holz Roh- u. Werkstoff* 17 (11), 1959 (440–7). 14 refs. [G.g.e.] P.R.

Discusses wood moisture content at the time of chipping, thickness of chips for the surface and middle layers, and the working life of the cutting blades. [Cf. *F.A.* 21 No. 1063.]

3847. BRENDEL, M. Das Verfahren der windgeschichteten Spanplatten. **[The sorting of particles into layers by air currents in the manufacture of particle board.]** *Holz-Zbl.* 86 (41), 1960 (619–20). [G.]

The principle of the method, by which layered particle boards are built up from particles blown through wind tunnels so that the finer particles come to rest at the bottom and top, and the coarser ones in the middle of a layer of particles formed on moving trays, is discussed; also the properties of the particles used (which need to be of better quality and greater uniformity as regards size, shape and moisture content than for boards built up from chips separately screened to different sizes), gluing, pressing, etc., and board quality.

3848. LYNAM, F. C. **Factors influencing the properties of wood chipboard.** *J. Inst. Wood Sci.* No. 4, 1959 (14–27): 2 refs.

Discusses these under the heads, (*a*) materials, and (*b*) modes of treatment: (*a*) covers wood (with its varying properties of density, compressibility, acidity [cf. *F.A.* 19 No. 4809], and including permeability), adhesives, water and wax, and (*b*) the treatment of these, separately, and in mixture, and of the pressed board. *From author's summary.*

3849. LIIRI, O. Tutkimuksia kosteuden ja kostumista hidastavan aineen vaikutuksesta lastulevyn ominaisuuksiin. **[Investigations on the effect**

**of moisture and wax upon the properties of wood particle board.**] *Pap. ja Puu* 42 (2), 1960 (43 . . . 56). 6 refs. [Fi.e.*e.*] P.R.

The main results of a study by the Laboratory of Wood Technology of the State Institute for Technical Research, Finland, were: (1) The results of tests of the hygroscopic properties of particle board, using the water-soaking method, vary considerably with the size of the sample and its position (vertical or horizontal) during soaking. The properties of the same board evaluated by different standard methods can vary widely, without any discoverable correlation; (2) Methods based on humidification are superior to water-soaking ones, because fewer variables are involved. (3) [Paraffin] wax retarded water absorption and swelling in soaking tests, being more effective in short-term tests. It did not affect bending strength but decreased tensile strength $\perp$ to the plane of the board by 7–8%. Its effects were most noticeable for an increase in wax content from 0 to 5%, based on dry resin. (4) Board strength was highest at a moisture content of 8–9%, corresponding to a relative humidity (r.h.) of 60–65% at 20° C. At very high r.h., board strength can decrease to $\frac{1}{2}$ the maximum. Even when the board contains wax, the strength decreases rapidly and considerably during soaking. *From author's summary.*

3850. Plath, E. Über den Einfluss der Härtung von Harnstoffharzen auf die Eigenschaften von Holzspanplatten. [**The influence of the hardening of urea resins on chipboard properties.**] *Holz Roh- u. Werkstoff* 17 (12), 1959 (490–4). 3 refs. [G.g.e.] P.R.

Hardeners were made using different proportions of $NH_4Cl$ and $NH_4OH$, and added at the rate of 10 parts, by weight, to every 100 of the urea resin Kauritlehm 285 which was used to make the boards (single-layer, Spruce surface chips, pressed at 140 ± 1° C., density 550 kg./cu.m.). Almost all the best values for board strength and stability were obtained with hardeners giving 1·5% $NH_4Cl$ in the urea-resin mix.

3851. Eisner, K., and Koleják, M. Niektoré základné otázky výroby trieskových dosák skráteným lisovaním. [**Some basic problems in producing chipboards with a short pressing cycle.**] *Drev. Výskum* 3 (2), 1958 (223–42). 10 refs. [Slovak.slovak.russ.g.e.] P.R.

Discusses the results of experiments with pressures, temperatures, and pressing times, and the effect of the pressing schedule on board strength.

3852. Iwashita, M., Ishihara, S., and Matsuda, T. [**Studies on manufacturing technique in overlaid particle board. I. The influence of differences in wooden core particle dimension upon the physical and mechanical properties of particle board.**] *J. Jap. Wood Res. Soc.* 5 (6), 1959 (230–5). 5 refs. [Jap.e.*e.*] P.R.

Describes the preparation of 45 × 45 × 2-cm. particle boards, and examines the relationships between particle size and the physical and mechanical properties of a veneer overlay (particle core and overlay both of *Shorea negrosensis*). Tabulated and graphed results (in English) are presented on: (1) the relationship between surface area, size of particles and resin coverage; (2) pressing schedules, indicating the sp. gr. of the board in relation to pressing time and pressure (kg./sq. cm.); (3) bending strength and Young's modulus of boards in relation to particle thickness, board density, and the grain direction of the overlay; (4) the effect of the overlay on screw-holding power, hygroscopicity, etc. of boards.

3853. Helge, K. **The influence of the contact area pressure on the results obtained by measuring the thickness of fibre building board.** *Norsk Skogind.* 14 (1), 1960 (19–25). [E.nor.] P.R.

An analysis of measurements on softboards and semi-hardboards at 8 pressures ranging from 100 to 1000 g./sq. cm. showed that pressure has a significant effect on results for softboards. A standard pressure of 500 g./sq. cm. is recommended for measurements of thickness of all types of fibreboard.

3854. Kitahara, K., and Nagahashi, A. [**On the preparation of fibreboard by wet process applying urea-resin.**] *J. Jap. Wood Res. Soc.* 5 (6), 1959 (201–7). 11 refs. [Jap.e.*e.*] P.R.

Tabulated data and graphs of the results of studies on the use of urea resins for improving the physical and mechanical properties of fibreboard indicate that (*a*) Young's modulus increases with increased resin retention (r.r.); (*b*) the modulus of rupture increases with r.r. when pressing temperature (p.t.) is low, and has a peak at 5% r.r. when p.t. is high [data given in English]; (*c*) Brinell hardness increases with r.r. The relationship between the absorbed energy in bending tests and r.r. is also indicated.

3855. Narayanamurti, D. **Fibre boards from Indian timbers.** *Indian For.* 86 (1), 1960 (5–15). 17 refs.

Reviews work done at the Forest Research Institute, Dehra Dun, on native hardwoods, softwoods, bamboos, barks, tapioca stems etc. Data on strength tests and physical properties of insulating and building boards are set out in tables and graphs.

### 863. Wood Hydrolysis. Saccharification

3856. Odintzow [Odincov], P. N., and Beinart [Bejnart], I. I. [**The effect of concentrated $H_2SO_4$ on Birch cellulose.**] *Latvijas PSR Zinātņu Akadēmijas Vēstis, Riga* 1958 (3), (67–72). [Russ.?] From *abstr.* in *Holzforschung, Berlin* 13 (5), 1959 (156). [G.] P.R.

Birch wood was hydrolysed at 40° C. in 30–40 min. with 65% $H_2SO_4$. Some 86·94% of the pentosans was hydrolysed in the first five minutes, while only 38·11% of the cellulose was hydrolysed in this time. The formation of reducing substances at the expense of pentoses stopped after 20 minutes, and then the reducing substances increased mainly as a result of cellulose saccharification. The cellulose hydrolysis constants were high at the beginning of the reaction, then fell to a minimum, and then increased again. This also applied to Fir wood, which takes longer to hydrolyse than Birch. The uneven course of cellulose hydrolysis is explained by the fact that the solution of cellulose takes place not only in the form of separated macro-molecules but also in the form of micelles.

### 865. Plastics

See Nos. 3739–40, 3771.

### 866. Utilization of Wood Extractives

See also Nos. 3206, 3878, 3881.

3857. CHOPRA, I. C., HANDA, K. L., and KAR, A. B. **Himalayan Cedarwood oil as a substitute for imported Cedarwood oil in microscopical work.** *J. sci. industr. Res. India* 18*C* (7), 1959 (133–4). 2 refs. P.O.

Oil from *Cedrus deodara* compared favourably with that of *Juniperus virginiana* for microscopic work.

### 867. Destructive Distillation

3858. BOLDT, C. E., and ARBOGAST, C., JR. **Charcoal kiln operation for improved timber stands.** *For. Prod. J.* 10 (1), 1960 (42–4).

Reports on a study, in a second-growth hardwood stand, of the manufacture of charcoal from unsaleable small wood so as to make improvement cuts profitable or at least economically possible, discussing the minimum prices that would have to be obtained in order to break even, at different costs for labour and wood.

3859. DARGAN, E. E., and SMITH, W. R. **Progress in charcoal production.** *For. Prod. J.* 9 (11), 1959 (395–7).

Describes a process in which sawdust or other residue is conveyed by screw feeds through tubes set in a chamber maintained at 800–900° F. Carbonization takes about 2 hours, after which the charcoal is sprayed with steam in order to cool and also to partially activate it. Once carbonization has started, the necessary heat is supplied by burning the gases from the carbonization process. A briquetting machine is being developed. Materials carbonized included Pine planer shavings, hardwood chips, bark and Pecan shells, with moisture contents from 5 to 150%. Yields averaged a little under 30% of oven-dry material.

## 89. Other ('Minor') Forest Products

### 892. Vegetable Products

See also Nos. 2709, 2820, 3292.

### 892.4. Bark Products. Tanstuffs. Cork

3860. ENDRES, H., and STADLER, P. Untersuchungen über die Sulfitierung der Phlobaphene des Fichtenrinden-Gerbstoffes. **[Experiments on the sulphidation of phlobaphenes from conifer-bark tannins.]** *Angew. Chem.* 71 (22), 1959 (704). [G.] O.R.S.

3861. GRASSMAN, W., and ENDRES, H. Über Polyhydroxystilbene, eine neue Klasse kondensierbarer Gerbstoffe. **[Polyhydroxystilbenes, a new class of condensable tannins.]** *Angew. Chem.* 71 (22), 1959 (703–4). [G.] O.R.S.

Piceatannol was obtained by extraction from *Picea abies*, *P. glauca*, *P. omorika*, *P. orientalis*, and *P. mariana*. Pungenin, isolated by Neish from *P. pungens*, was found also in *P. glauca*; greatest quantities were present in winter.

3862. KAYACIK, H. Hatay meşesi (*Quercus pseudo-cerris* Boiss.) ve kabuklarından dan faydalanma imkânlari. **[*Q. pseudo-cerris* and the importance of its corky bark.]** *Istanbul Üniv. Orm. Fak. Derg.* 9*A* (1), 1959 (11–21). 9 refs. [Turk.g.*g*.]

Describes the tree, and attempts in Turkey to use its bark as a source of cork. *Q. pseudo-cerris* cannot, however, replace its bark continuously, so that cork can be obtained only from the bark of felled trees. The cork is not as good as that of *Q. suber*.

3863. MANSON, D. W. **The leucoanthocyanin from Black Spruce inner bark.** *Tappi* 43 (1), 1960 (59–64). 37 refs. P.R.

Briefly examines the literature on leucoanthocyanins in woody plants, and describes experiments on the isolation of leucoanthocyanin from the inner bark of *Picea mariana*. It was estimated to constitute ca. 10% of the original crude extract from the bark.

3864. PLOUVIER, V. Sur quelques constituants des écorces de *Prunus mahaleb* L. **[Some bark constituents of *P. mahaleb*.]** *C.R. Acad. Sci., Paris* 250 (3), 1960 (594–6). 4 refs. [F.f.] O.R.S.

The following were isolated: prunetine, prunitroside (heteroside of prunetine), methoxy-7-coumarine and a new heteroside, mahaleboside, $C_{15}H_{16}O_8$.

3865. PEARL, I. A., and DARLING, S. F. **Studies on the barks of the family Salicaceae. II. Salireposide from the bark of *Populus tremuloides*.** *J. organ. Chem.* 24 (10), 1959 (1616). 7 refs. O.R.S.

[Cf. *F.A.* 21 No. 1203.] The glucoside from the bark, originally reported to be populin, proved on re-examination to be salireposide, not found before in *Populus* spp. Substantial amounts of salicin and tremuloidin were also found. Populin is present in the bark of *P. tremula* and *P. alba*.

### 892.5. Medicinal Plants, Edible Plants, Insecticides from Plants, etc.

See also section 160 and Nos. 2716–7, 3864–5.

3866. OLIVER, B. **Nigeria's useful plants. Part II, Medicinal plants.** *Nigerian Field* 25 (1), 1960 (46–8).

[Cf. *F.A.* 21 No. 2560.] A list of authorities and references having special application to the medicinal plants, plus addenda and corrigenda to the previous articles dealing with the medicinal plants.

3867. GILMAN, R. E. **An investigation of the alkaloids of *Alstonia muelleriana*.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (5), 1959 (1578–9). O.R.S.

Four apparently new alkaloids were isolated. Their formulae and melting points are given.

3868. NEUSS, N. **Alkaloids from Apocynaceae. II. Ibogaline, a new alkaloid from [the ground root of] *Tabernanthe iboga* Baill.** *J. organ. Chem.* 24 (12), 1959 (2047–8). 11 refs. O.R.S.

3869. SCHMUTZ, J., and HUNZIKER, F. Die Alkaloide von *Aspidosperma olivaceum* M.Arg. *Aspidosperma*-Alkaloide, 3 Mitteilung. **[Alkaloids of *A. olivaceum*. *Aspidosperma* alkaloids, 3.]** *Pharmaceutica Acta Helvetiae, Zürich* 33, 1958 (341–7). 7 refs. [G.g.f.e.it.]. P.O.

[Cf. *F.A.* 21 No. 1205.] Uleine ($C_{18}H_{22}N_2$) and a new alkaloid, olivacine ($C_{17}H_{14}N_2$) were isolated from root- and stem-bark, and from leaves.

3870. ONDETTI, M. A., and DEULOFEU, V. **Alkaloids from *Aspidosperma australe* Müll. Argov. [I] Relationship of olivacine to *u*-alkaloid C. (Note II). The structure of olivacine and *u*-alkaloid C.** *Tetrahedron Letters, London* 1959 (7), (1–7); 1960 (1), (18–22). 10 refs. [E.] O.R.S.

3871. ROSCOE, C. W., and HALL, N. A. **A preliminary study of the alkaloidal principles of [root barks of *Ceanothus americanus* and *Ceanothus velutinus*.** *J. Amer. Pharm. Ass.* (*sci. Ed.*) 49 (2), 1960 (108–12). 16 refs. O.R.S.

3872. CHATTERJEE, A., BOSE, S., and GHOSH, C. **Rhetsine and rhetsinine, the quinazoline alkaloids of *Xanthoxylum rhetsa*.** *Tetrahedron, Lond.* 7 (3/4), 1959 (257–61). 4 refs. [E.e.] O.R.S.

Lupeol and four alkaloids, chelerythrine, rhetine, rhetsine and rhetsinine were isolated from the trunk bark. The constitution of the last two was determined.

3873. ARTHUR, H. R., HUI, W. H., and NG, Y. L. **An examination of the Rutaceae of Hong Kong. Part III. The alkaloid, avicine, from *Zanthoxylum avicennae*.** *J. Chem. Soc.* Dec., 1959 (4007–9). O.R.S. [Cf. *F.A.* 21 No. 1219.]

3874. KARRER, P., *et al.* Neuere Ergebnisse der Calebassen-Curare-Forschung. **[Recent results of research on Calebasse-curare.]** *Angew. Chem.* 70 (21), 1958 (644–5). 14 refs. [G.] O.R.S.

A short review of recent work by the authors on the structure of Calebasse-curare and *Strychnos* bark alkaloids. [Cf. *F.A.* 17 No. 1037.]

3875. HESSE, G. Giftstoffe aus einem afrikanischen Pfeilgift. **[Poisonous substances from an African arrow poison.]** *Angew. Chem.* 71 (6), 1959 (223). 3 refs. [G.] O.R.S.

Describes the structure of poisons isolated from the sap of *Calotropis procera*.

3876. CHAKRABORTY, D. P., PURKAYASTHA, M., and BOSE, P. K. **On the antibiotic properties of some constituents of *Mesua ferrea* Linn.** *Proceedings of the National Institute of Sciences, New Delhi 25B* (1), 1959 (8–11). 14 refs. O.R.S.

The antibiotic activity of mesuol, mesuone, and kernel and shell oils of the seeds was studied. Mesuol and mesuone were found to be fairly antibacterial. Mesuol is about 1% as active as penicillin against *Staphylococcus aureus*. None of the constituents was active against any of the [four] fungi tested. *From author's summary.*

3877. STOLLER, L. **Ylang ylang for perfume.** *Givaudanian* April, 1959. From *abstr.* in *Econ. Bot.* 13 (4), 1959 (370).

Discusses the harvesting and utilization of the flowers of *Canangium odoratum*, a tree 60–80 ft. high, native to China and Burma but of commercial importance today in the islands of Réunion, Nossi Bé, Madagascar, and the Comoros. The flowers are used medicinally and in the manufacture of perfumes.

### 892.6. Resin and Turpentine. Essential Oils. Fixed Oils and Fats. Gums. Latex. Dyestuffs. Sap Sugar

See also Nos. 3187–90, 3900.

3878. KAMINSKI, E. **Naval stores output, methods, wood, statistics in Poland.** *Naval Stores Rev.* 69 (7), 1959 (6–7, 16).

Reviews methods used in resin tapping and in extraction of resin from stumpwood and from pulping wastes, with a table giving figures of production in 1957 and 1958.

3879. **A sample of oleo-resin from *Pinus elliottii* from Mauritius.** *Trop. Sci.* 1 (3), 1959 (215–6).

An analytical report. The sample produced an average yield of good-quality turpentine, the constants of which satisfied the British Standard Specification entirely and only failed to satisfy the A.S.T.M. Specification in respect of the residue after polymerization. Mauritius turpentine was found to contain 38·8% of α-pinene and 55·4% of β-pinene vs. 62 and 34 respectively for turpentine from *P. elliottii* in the U.S.A. It is very unusual for a turpentine to contain more β- than α-pinene, but this would not lessen its commercial value. The constants of the rosin are just outside the ranges of normal U.S. rosins.

3880. CHEUVART, C. F. Évolution de la teneur en acide de la résine de *Guibourtia demeusei* (Harms.). **[The development of acid content in *G. demeusei* resin.]** *Extr.* from *Rapp. Inst. Rech. Sci. Afr. Cent., Bruxelles 1958*, 1959 (187). [F.]

Acid content was found to decrease from an index of 64–74 for fresh resin to 49–54 after one year.

3881. **Essential oils and aromatic chemicals. A symposium held at Dehra Dun October 6–9, 1955 under joint auspices of C.S.I.R. and the Forest Research Institute and Colleges.** Council of Scientific and Industrial Research, New Delhi. 1958. pp. xx + 174. Many refs. [E.] L.T.P.

Includes papers on: Manufacture of concretes and absolutes from Indian flowers (*C. Goldstein*) [listing, among promising species, *Acacia farnesiana*, *A. arabica*, *Alangium salviifolium*, *Cassia fistula*, *Daphne cannabina*, *Lawsonia inermis*, *Mesua ferrea*, *Michelia champaca*, *Mimusops elengi*, *Murraya paniculata*, *Nyctanthes arbor-tristis*, *Ochrocarpus longifolius*, *Pandanus odoratissimus*, *Plumeria acuminata*]; Essential oil resources of Assam (*B. Saikia*) [discussing

mainly the production of (*a*) turpentine from *Pinus khasya*, with a brief history of both tapping and distilling since 1953 [cf. *F.A.* 18 No. 2879] and comparative analyses of the oil; (*b*) agar oil from the diseased resinous wood of *Aquilaria agallocha*—brief history, recent investigations on distilling, analysis of the oil, and prospects of development [cf. *F.A.* 13 No. 3477]; (*c*) camphor from *Ocimum kilimandscharicum*, now being experimentally cultivated by the forest department (yields given) [cf. *F.A.* 12 No. 1475]; (*d*) Sandalwood oil from *Santalum album* trees introduced since World War II]; Some aromatic plants of Jammu and Kashmir (*K. L. Handa* and *L. D. Kapoor*) [a preliminary survey revealing the presence of nearly 100 aromatic species, including *Juniperus communis*, *J. macropoda*, *Saussurea lappa*, and *Xanthoxylum alatum*, with brief data on the properties of their oils]; Cultural studies of essential-oil-bearing plants raised in Jammu and Kashmir (*L. D. Kapoor* and *K. L. Handa*) [including analysis of oils from *Eucalyptus viminalis* and *E. citriodora* grown in Jammu]; Rosha grass [*Cymbopogon martini* Wats.] farming as a cottage industry (*R. Singh*) [including a brief account of an experimental plantation started in a *chaor* (grassy blank) in the Dehra Dun forests in 1952, yielding good-quality oil]; An evaluation of some indigenous perfume bearing materials (*G. S. Hattiangdi* and *N. A. Nimbalkar*) [reporting in detail the results of trial distillations from 9 plant sources not yet commercially exploited in India, including *Cinnamomum zeylanicum* (bark, buds, twigs), *Acorus calamus* (rhizomes), *Hedychium spicatum* (rhizomes), *Nardostachys jatamansi* (roots) and *Luvunga scandens* (berries)—the last four being common exports from the Kumaon Himalayas and two of them, the *Acorus* and *Hedychium*, offering distinct commercial possibilities]; Chemical examination of the essential oil from *Eugenia jambolana* leaves (*S. K. Ramaswami* and *D. R. Dhingra*); Hydration of longifolene (*U. R. Nayak* and *S. Dev*) [the essential oil of *Pinus roxburghii*]; Antibacterial activity of a few common essential oils (*M. George* and *K. M. Pandalai*) [tabulating results of standard tests on 12 freshly distilled oils; among which *Eucalyptus* (unspecified) and Pine (*P. roxburghii*? needle oil?) proved highly inhibitory to gram-negative organisms like *Bacillus dysenteriae*, and Pine turpentine inhibitory to both gram-negative and gram-positive; Cedar, Clove and Sandalwood oils are also reported on].

3882. PENTEGOV, A. P., and ČIRKOVA, M. A. Ispol′zovanie hvoi pihty sibirskoj dlja polučenija pihtovogo masla i kamfary. **[Utilization of *Abies sibirica* needles for the production of oil and [synthetic] camphor.]** *In* 'Sbornik Statej po Rezul′t. Issled. v Oblasti Lesn. Hoz. i Lesn. Prom. v Taežnoj Zone SSSR'. Moscow. 1957. pp. 283–8. 10 refs. [Russ.]

Compares the oil yields and bornyl-acetate content of *A. sibirica* with those of *A. alba*, *A. nordmanniana*, and *A. balsamea*, and tabulates the physical and chemical properties of *A. sibirica* oil and terpenes, the chemical composition of the oil, and the bornyl-acetate and borneol contents of the oil (the only raw material used in the U.S.S.R. for producing synthetic camphor).

3883. TRIANTAPHYLLIDIS, G. Daphnē hē eugenēs. **[The Sweet Bay [*Laurus nobilis*].]** *Das. Chron.* 1 (11), 1959 (481–4). [Gk.]

Gives some account of its distribution in Greece, its botanical characters, and the export value of its oil (earnings $800,000 in 1958), and makes recommendations for increasing its production and exploitation on an organized basis.

3884. SUKAČEV, V. N., and PRAVDIN, L. F. [Editors]. Beresklet kak guttaperčenos i naučnoe obosnovanie ego kul′tury i ėkspluatacii. **[*Euonymus* as a source of guttapercha, and the scientific basis of its cultivation and utilization.]** *Trud. Inst. Les.* No. 46, 1958. pp. 153. Many refs. [Russ.]

Papers delivered at the 1955 Soviet Conference [cf. *F.A.* 13 No. 4433], of which the most important are: Present state of research on *Euonymus* spp. yielding guttapercha (*L. F. Pravdin*); Growing plants yielding guttapercha in the U.S.S.R. (*M. G. Pinčuk*); New method of determining guttapercha content, and the possible use of *Euonymus* bark residues in industry (*Ja. S. Ogloblin*); *E. verrucosus* on the steep calcareous slopes of the central Desna basin (*V. A. Filin* and *Ja. S. Ogloblin*); The growth of *E. europaeus* in natural thickets, and its cultivation on peat soils (*N. V. Šeluhin*); Harvesting *Euonymus* roots, and their natural regeneration (*P. V. Sapankevič*); Natural regeneration of *E. europaeus* (*A. I. Buzinova*); Methods of propagating *Euonymus* spp. vegetatively (*A. A. Čevedaev*); Results of experiments on earthing up *Euonymus* stems (*P. I. Čujkov*); The accumulation of guttapercha in the bark of earthed-up *Euonymus* stems (*N. V. Mackevič*); Techniques of growing *E. europaeus* in plantations and artificial forest stands (*F. N. Haritonovič*); Influence of fertilizers on the growth and fruiting of *Euonymus* (*I. D. Jurkevič*); Effect of spacing on the yield of *E. europaeus* in plantations (*V. S. Gabaj*); Suitable mixtures with *E. europaeus* in forest plantations in the N. Caucasus (*M. I. Pekšibaev*); Seed maturity and duration of dormancy (*P. V. Sapankevič*).

### 892.7. Fruits. Seeds. Fibres, Yarns and Flosses

See also Nos. 2824, 3900.

3885. ASENJO, C. F. Aspectos químicos y nutritivos de la acerola (*Malpighia punicifolia* L.). **[Chemical and nutritive properties of *M. punicifolia*.]** *Ciencia, Mexico* 19 (6/7), 1959 (109–18). 48 refs. [Span.span.e.]

A summary of information based on literature mainly from the western hemisphere and dealing with nomenclature, distribution, chemical constituents of the fruit, methods of processing, biological tests on humans and animals, and mineral requirements of the tree.

### 892.8. Heather. Broom etc. Osiers. Canes and Bamboos. Reeds and Rushes. Thatching Materials

See No. 3802.

# 9. FORESTS AND FORESTRY FROM THE NATIONAL POINT OF VIEW. SOCIAL ECONOMICS OF FORESTRY

## 90. General

See also Nos. 3595, 3913.

3886. BERTHON, P. F. Informe al gobierno del Ecuador sobre el desarrollo de las industrias forestales en las regiones de Guayaquil y San Lorenzo. **[Report to the government of Ecuador on the development of the forest products industries in the regions of Guayaquil and San Lorenzo.]** Expanded Technical Assistance Program, FAO, Rome. *FAO Report* No. 1125, 1959. pp. iii + 55 + 1 map + 1 tbl. [Span.]

The report is in two parts: (1) *Guayaquil.* Gives a description of the region, the present exploitation of the forests, the existing sawmills, and present trade in sawn timber, with recommendations for future development. (2) *San Lorenzo.* Presents a general description of the region, an estimate of the forest resources,and their exploitation, which is at present primitive, and makes recommendations for their future development, with a special section on the exploitation of the Mangrove forests.

3887. JOHNS, J. H. G., and CHAVASSE, C. G. R. **Westland's wealth.** *Inform. Ser. N.Z. For. Serv.* No. 29, 1959. pp. 68.

Designed to show pictorially (57 photographs) that Westland's wealth and future prosperity depend largely on wise use of its forests, and how these forests are threatened by introduced mammals, uncontrolled logging and fire.

## 902. History of Forests and Forestry

See No. 2891.

## 903. Forest Policy, General

3888. BOSSHARD, W. Über Probleme und Bedeutung der forstlichen technischen Hilfe. **[Technical aid in forestry, its problems and importance.]** *Schweiz. Z. Forstw.* 111 (2), 1960 (67–81 + 3 photos). 13 refs. [G.f.]

A discussion based on the author's experiences as ETAP adviser to Ethiopia. He considers the safeguarding of food production for the increasing population the first task of forestry development in underdeveloped tropical countries, i.e. stress to be laid on the conservation aspects, on shelterbelts etc. (with wood production an important but secondary issue). Hence the closest possible cooperation at all levels, with agricultural and other experts, and the formulation of a land-use policy are considered essential. Training of foresters, building up of a forest administration, research, etc. are discussed, with emphasis on the need for technical aid to be integrated in a general scheme for cultural advance and for technical advisers to be aware of the wider issues involved.

3889. SAMPAIO, J. SALAZAR. Política florestal e crescimento económico. **[Forest policy and economic development.]** Direcção Geral dos Serviços Florestais e Aqüícolas, Lisbon. 1959. pp. 41. [Port.f.]

Discusses basic principles to be considered when formulating a forest policy, particularly in relation to other economic spheres, such as agriculture and industry.

3890. SMITH, J. S. **Past, present, future—a review.** *Malay. Forester* 22 (4), 1959 (272–80).

A review of Malayan forest policy, written in the first place for the Annual Report of the Forest Department, 1958.

## 904. General Regional Accounts of Forests and Forestry

3891. Número especial dedicado ao Ultramar. **[Special number devoted to overseas possessions.]** *Agros* 42 (4), 1959. pp. 491. Many refs. [Port.]

This complete number devoted to Portuguese overseas territories includes the following articles of forestry interest: African woods for flooring (*M. P. Ferreirinha*); Agricultural and forestry evolution in Angola from the point of view of social economy (*G. Guerra*); Aspects of tropical silviculture —closed moist forest (*R. F. R. Monteiro*) [with special reference to Angola]; The importance and some present aspects of agriculture and forestry development in Mozambique—forestry and agricultural policy (*A. M. da Silva*); Overseas forest entomology (*C. M. B. Neves*).

3892. KOLDANOV, V. JA. Lesa Dal′nego Vostoka i Amurskaja problema. **[Forests of the [Soviet] Far East, and the Amur problem.]** *Soobšč. Inst. Les.* No. 12, 1959 (3–11). 2 refs. [Russ.]

Discusses joint Sino-Russian work on the problems of forestry in the Amur Basin (1·6 million sq. km. of forest land on the Soviet side, 1·4 million on the Chinese), together with proposals for future measures.

3893. BÉGUÉ, L. **The forests of the republic of the Sudan.** *Sudan Silva* 9 (1), 1959 (11–20). Transl. from *Bois For. Trop.* No. 62, 1958 (197–217). [See *F.A.* 20 No. 4000.]

3894. BOSSHARD, W. C. **Report to the Government of Ethiopia on forestry development.** Expanded Technical Assistance Program, FAO. *FAO* No. 1143, 1959. pp. 13 + 3 pp. of drawings. Limited distribution.

Includes a list of proved and promising exotics.

3895. MOONEY, H. F. **Report on the forests of Southern Balé in Harrar Province of Ethiopia.** British Middle East Development Division, Addis Ababa. 1960. pp. 10 + 13 photos. Limited distribution.

Describes 5 main vegetation types: the Tidh or Juniper, the Zigba or *Podocarpus*, the Karuro or Guracha (*Aningeria adolfi-friederici*) and the Karkaha (*Arundinaria alpina*) forests and the dry *Terminalia/Combretum* woodlands, and urges a stop to the present rapid rate of destruction.

3896. Najera y Angulo, F. El bosque y las maderas tropicales de Guinea en la economía nacional. **[The forests and tropical timbers of Spanish Guinea in the national economy.]** Sección de Publicaciones de la Escuela Especial de Ingenieros de Montes, Madrid. 1957. pp. 33. [Span.]

Presents a short description of the forests (with particular reference to Okoumé) and of present methods of exploitation, with brief recommendations for future management, and discusses in general terms the characteristics, uses and marketing of tropical timbers, the uses of Guinean timbers, and the resources of the Guinean forests.

3897. Gillardin, J. Les forêts du Congo belge. **[The forests of the Belgian Congo.]** *Bull. agric. Congo belge* 50 (4), 1959 (1017–36). [F.f.du.]

Describes their extent and type and lists the principal species exploited. Production and export figures are given, with a brief account of salient characteristics of current forestry and of future policy and research objectives.

3898. **The forest resources of Alaska. The significance of their conservation in the growth and development of Alaska.** Bureau of Land Management, U.S. Department of the Interior, Washington, D.C. 1958. pp. 7.

Describes the land, its climate, and the forests, most of which are in public ownership. In the coastal forests, of which 4 million acres are classed as commercial, Western Hemlock predominates, and in the interior forests (ca. 125 million acres, most of which is ravaged by fire) White Spruce, with Spruce/Birch the most widely distributed forest type. Prospects of exploitation, recreation, etc. are discussed, and in particular, the fire problem. Unless fire losses are reduced, the rising scale of cutting will deplete the forest resource. [Cf. *F.A.* 13 No. 3517.]

### 905. Forest Statistics and Resources

See also Nos. 3613, 3616, 3906–7.

3899. Bérard, A. Évolution des forêts vosgiennes. **[The evolution of the forests of the Vosges.]** *Rev. for. franç.* 12 (3), 1960 (190–7). [F.]

Presents and discusses comparative statistics for 1878 and 1957 on the extent of the forests, distribution of species, areas under different types of management, production (by assortments) and financial yield.

3900. Florov, D. N. Kedr i ego ispol′zovanie v narodnom hozjajstve SSSR. **[*Pinus sibirica* and its utilization in the national economy of the U.S.S.R.]** *In* 'Sbornik Statej po Rezul′t. Issled. v Oblasti Lesn. Hoz. i Lesn. Prom. v. Taežnoj Zone SSSR'. Moscow. 1957. pp. 133–40. [Russ.]

Discusses the area of *P. sibirica* forests in the various regions, seed production, oil and timber yields, forest types and regeneration, and insect pests,and makes recommendations on the protection and utilization of the forests.

3901. **Saskatchewan's forest inventory 1947 to 1956.** Forestry Branch, Department of Natural Resources, Regina. 1959. pp. 127 + 1 map. 20 refs.

In addition to data on forest types, ages, volumes, regeneration etc. in accessible and potentially accessible forests, local volume tables are presented for *Picea glauca* and *P. mariana*, *Pinus banksiana*, *Abies balsamea*, *Larix laricina*, *Populus tremuloides*, *P. balsamifera* and *Betula papyrifera*, and a coloured map (1 in.:16 miles) of cover types.

### 907. Indirect Significance of Forests (Rural Amenity, National Parks, Forest Influences etc.)

See also section 116.

3902. Holloway, J. T., and Naylor, R. **Protection-forest problems in Nelson-Marlborough: a preliminary review.** *N.Z. J. For.* 8 (1), 1959 (121–32).

Reviews the state of the forest in the various catchments, with particular reference to the increase in erosion risk due to noxious animals, particularly goats.

### 91. Land Use, Land-Use Policy (including Afforestation Policy)

See also section 116 and Nos. 2623, 3162, 3595, 3889, 3891, 3913.

3903. **[Agriculture on rolling terrain.]** *Report of the Research Institute, Agricultural Section, College of Agriculture, Tokyo* No. 1, 1958. pp. 48 + 3 maps, 2 photos. Many refs. [Jap.]

This, the first of a series of reports, describes the climate, topography, soil, and existing forest growth of special areas in the neighbourhood of Tokyo for which a land-use plan is projected. This type of rolling upland covers some 5 million chos of Japan, as compared with 6 million of arable; of these 5 million, 2 million are considered suitable for agriculture and 3 million for forestry.

3904. Poli, A., and Roberts, E. V. **Economics of the utilization of commercial timberland on livestock ranches in northwestern California.** *Misc. Pap. Calif. For. Range Exp. Sta.* No. 25, 1958. pp. 51. 18 refs.

In a joint Agriculture and Forest Service study, the advisability of converting Douglas Fir woodland to grass was investigated. The conversion process was found to require long and careful management and to cost ca. $26/acre vs. an economic limit of ca. $20. The upper limit for total investment per acre of converted land, including cost or value of clear-felled land, was ca. $30. If Douglas Fir woodland were retained, planting might be necessary to ensure adequate reproduction ; ≯ $50/acre could profitably be spent on re-stocking medium-quality (site-III) land, more on good land (sites I and II). Calculations showed that sites I and II would yield more if left as woodland than if converted to grass. Site-III land with a S. or W. exposure would yield more in grass, but N. or E. exposures would yield more in timber.

3905. Petriceks R., J. Relación entre el área e intensidad de la agricultura migratoria en Venezuela. **[Relationship between [forest] area and intensity of shifting cultivation in Venezuela.]** *Bol. Inst. For.*

*Latino Amer., Mérida* No. 4, 1959 (80–97 + [2] + 1 map). 8 refs. [Span.e.]

Figures are presented for areas cleared (high and low forest and scrub) by permit from 1946 to 1957 inclusive. For high forest they show an increase from a total annual area in 1946 of ca. 2000 ha. to ca. 40,000 ha. in 1957. Large but less spectacular increases occur also in the other types. Greatest *per capita* intensity of deforestation is recorded from the western states of Portuguesa, Barinas, Yaracuy, and Zulia, and in Guárico in the East; shifting cultivation is most widespread in areas of highest density of rural population and greatest accessibility, but not necessarily with the greatest % of forest area. In order to maintain an adequate distribution of forests over the whole country, it is necessary to define and protect strictly the forest areas considered indispensable.

### 92. Forest Ownership and Ownership Policy

3906. McMahon, R. O. **A new technique for estimating forest-land areas by ownership class.** *Agricultural Economics Research, Washington* 11 (2/3), 1959 (81–8). 20 refs. C.G.B.

Discusses aims and techniques of ownership surveys, and describes a technique based on a selection of sampling points by random numbers (of small administrative units) used in an analysis of privately owned forests by ownership and stand size classes, in an Oregon county, where maps of forest types and broad ownership categories already existed.

3907. Linnamies, O. Valtion metsät sekä niiden hoiden ja käytön yleissuunnitelma. Vuosien 1951–1955 inventoinnen tuloksia. **[The state forests of Finland and a general management plan for them based on an inventory made in 1951–55.]** *Acta for. fenn.* 68 (5), 1959. pp. 225. 42 refs. [Fi.e.*e*.]

Gives data from a detailed supplementary survey of state forests in 1954–55 based on the Third National Forest Inventory 1951–53 [cf. *F.A.* 19 No. 5031; 20 No. 1308] with measures to be taken during the forthcoming 8-year Silvicultural Programme. A 20-page English summary includes consolidated data from the many tables.

3908. Meyer, W. H. **Impressions of industrial forestry in Southeastern United States.** *J. For.* 58 (3), 1960 (179–87).

The author spent nearly 2 months in S. and S.E. United States in autumn 1958, interviewing the heads of various industrial woodlands and forestry organizations or their representatives. He comments on the labour force; organization, functions, size, etc. of forest units; choice of species, rotation etc.

3909. Sutherland, C. F., and Tubbs, C. H. **Influence of ownership on forestry in small woodlands.** *Sta. Pap. Lake St. For. Exp. Sta.* No. 77, 1959. pp. iii + 21 + 1 dgm. 4 refs.

Presents the results of a detailed survey undertaken in central Wisconsin in 1958 to determine, by interview and examination of woodland, various characteristics of private owners of woodlots and their attitude towards their forest land. Emphasis was laid on the reasons why specific forestry practices were or were not adopted, and why owners did or did not respond to specific forestry programmes, both government and private.

3910. Venville, C. R. G. **The place of private forestry.** *For. tech. Pap. For. Comm. Vict.* No. 2, 1959 (3–7).

Briefly discusses the extent of private forestry in different countries, with reference to the function of government in preventing misuse and providing incentives by integrating private interests with national forest policy. The situation in Victoria is especially examined.

### 93. Public Supervision and Regulation of Forestry, including Legislation for these Purposes

3911. Pavari, A. Su un importante problema di politica forestale. **[An important problem of forest policy.]** *Monti e Boschi* 11 (1), 1960 (3–14). [It.it.e.]

Discusses the proposed law setting up a new organization to administer all publicly owned forests, i.e. both state forests and those belonging to municipalities, communes etc.

3912. Trifone, R. A proposito di una proposta di legge per la costituzione dell' Azienda nazionale autonoma forestale. **[The proposed law for setting up an autonomous national forestry enterprise.]** *Ital. for. mont.* 14 (6), 1959 (236–42). [It.it.f.]

Criticizes the proposal and suggests that its objects could be better achieved by enforcing existing laws and leaving the management of state, royal, and communal forests in the hands of the authorities at present responsible for them.

3913. Gussmann, H. U. Eine forstliche Gesetzgebung in Chile. Die Herleitung ihrer Notwendigkeit und ihres Inhalts aus den gegebenen Verhältnissen und künftigen Erfordernissen. **[Forestry legislation in Chile. Deducing its necessity and content from existing conditions and future needs.]** Buchdruckerei Chr. Gulde, Tübingen. 1958. pp. 120 + 61 photos. 92 refs. [G.]

Describes past and present extent and conditions of the forests, their ownership pattern, economic role etc., and discusses principles of forest policy and their implementation. Stresses the need for comprehensive land-use legislation as a first step towards the definition and demarcation of forest land, followed by enactments to regulate or prohibit forest clearing, burning, felling, grazing, etc., and later by positive measures such as grants for roads or afforestation.

### 94. Other Methods to Implement Forest Policy.

#### 945.1. Advisory and Information Services, Documentation Centres

See No. 3888.

#### 945.2. Publicity, Propaganda (including Demonstration Forests)

See also Nos. 2938, 3909.

3914. **National progress reports on forestry 1957–58. Forestry films.** [*Docum.*] *10th Sess.*

*FAO/EFC, Rome 1959* No. *FAO/EFC*-59/26, 1959. pp. 39.

A note by the Secretariat, embodying the recommendations of the Joint FAO/IUFRO Committee on Bibliography, together with a list of ca. 50 recent films from 11 countries, with production data, synopses, names of distributors etc.

### 945.3. Education. Training. (Including Educational Tours and Information on Careers)

3915. Ferenc, L. Bányászati, kohászati és erdészeti felsöoktatásunk története 1735–1935. 6. Füzet. A Selmecbányai erdészeti tanintézet története (1808–1846). **[History of higher education [in Hungary] in mining, metallurgy and forestry, 1735–1935. Number 6. History of the Forestry School at Selmecbánya, 1808–1846.]** *Erdészettud. Közl., Sopron* 1958 (2). pp. 119 + 13 plates. Many refs. [Hu.russ.g.f.]

3916. **Forestry: Choice of careers No. 81.** H.M. Stationery Office, London. 2nd ed., 1959. pp. 36. Price 1*s*. 9*d*.

[Cf. *F.A.* 19 No. 1252.] Includes brief information and advice for adults on careers in administrative, managerial and senior executive positions.

### 945.4. Research

See also Nos. 2843, 3129–30, 3198, 3836.

3917. Sbornik statej po rezul'tatam issledovanij v oblasti lesnogo hozjajstva i lesnoj promyšlennosti v taežnoj zone SSSR. **[Collected papers on results in forestry and forest industries research in the taiga zone of the U.S.S.R.]** Akademija Nauk SSSR, Moscow & Leningrad. 1957. pp. 301. Many refs. [Russ.] Price *Roubles* 17.50.

Thirty conference papers on various aspects of forestry and forest industries in the zone (some being general review articles, others giving research results) under the main heads: General problems of research on forestry and forest industries (3 articles); Investigations on the vegetation and management of the taiga forests (3 articles); Regeneration on felled areas, and seed problems (8 articles); Waterlogging, drainage, and protection against diseases and pests (5 articles); Mechanization and electrification of logging (4 articles); Utilization of wastes (wood, slash, pulping wastes) for fuel, power and chemical products (7 articles). Some of the articles are noticed separately in this issue of *F.A.*

3918. Inou(y)e, M. **Outline of the Government Forest Experiment Station, Hokkaido Branch.** *Extr.* from *Ann. Rep. For. Exp. Sta., Hokkaido 1958*, 1959 (158–84). [E.]

An account of its activities and organization, on the occasion of the 50th anniversary of its foundation. Includes a list of publications.

3919. Engledow, Sir F. **Federation of Nigeria: Report by Sir Frank Engledow, C.M.G., F.R.S., on the Federal Organisation for Agriculture, Veterinary, Forestry and Fisheries Research.** Federal Government Printer, Lagos. 1959. pp. 14. (*Sessional Paper* No. 4 of 1959.) Price 9*d*.

3920. L'Institut National pour l'Étude Agronomique du Congo Belge (INÉAC): son but, son programme, ses réalisations. **[INÉAC: its objects, importance, and achievements.]** Institut National pour l'Étude Agronomique du Congo Belge, Brussels. 5th ed., 1959. pp. 168 + 1 map. [F.] [Cf. *F.A.* 19 No. 3717.]

3921. Le laboratoire de recherches forestières, Québec, Qué. **[The Forestry Research Laboratory, Quebec.]** Forestry Research Laboratory, Quebec. [1959?]. pp. 16. [F.E.]

Describes the Laboratory and gives some account of research carried out there since its foundation.

### 946.2. Conferences and Excursions

See also No. 2752.

3922. Mobbs, E. C. **Forestry at the British Association 2nd to 9th September, 1959.** *Emp. For. Rev.* 38 (4), 1959 (412–9).

Summarizes the principal papers read in the Forestry Section, including: The influence of pathogenic factors in the rooting space on the development of even-aged plantations (*W. R. Day*); Shelter needs in relation to land use (*J. E. Nichols*); The planning of shelterbelts: design and structure (*J. M. Caborn*); Damage by roe deer, and methods of protection (*J. S. R. Chard*); Physiological research on forest works as an aid to increased efficiency and improved working methods (*U. Sundberg*); Work study in British forestry (*J. W. L. Zehetmayr*); The extraction of thinnings by horse (*R. E. Crowther*); Heart rots of standing trees: their recognition and significance (*W. P. K. Findlay*); *Fomes annosus* in Britain (*J. D. Low*); Decay as a source of economic loss in Spruce (*J. G. Dowden*).

3923. Robertson, W. M. **Society of Foresters of Great Britain excursion to the north of Scotland, 21st–25th September, 1959.** *Emp. For. Rev.* 38 (4), 1959 (388–411).

Describes visits to Glen Affric and Guisachan, to Strathspey, to the Black Isle and to Lethen and Cawdor and presents synopses of 4 papers read at the technical discussion: The native Pinewoods and their management (*H. M. Steven*; 2 refs.); The formation of Scots Pine plantations with particular reference to seed provenance (*M. V. Edwards*); Management of Scots Pine plantations (*D. J. Brodie*); The utilisation of Scots Pine (*W. J. Riddoch*).

3924. Norrlands Skogsvårdsförbunds exkursion till Ångermannland den 14 och 15 September 1959. **[The excursion of the Norrlands Skogsvårdsförbund to Ångermannland, 14 and 15 Sept. 1959.]** *Norrlands SkogsvFörb. Tidskr.* 1959 (4), (485–623). [Sw.]

Gives an account of the excursion and includes texts of papers read, with discussion. The success of various regeneration methods in the forests of Bjorkå och Forss AB is discussed in a paper by *R. Ruben*, and various transport problems (the relative costs of floating, lorry, tractor, and horse transport; damage to standing trees by tractor extraction, etc.) in papers by *F. v. Heideken*, *P.-E. Esseen*, *E. Malmberg*, *S. Carlsson*, and *L. Dahlstedt*.

3925. **A short summary of the proceedings of the tenth Australian Forestry Conference at Tumut, New South Wales in May 1959 with the resolutions passed at it.** *Emp. For. Rev.* 38 (4), 1959 (365–70).

### 95. Forest Taxation

See also Nos. 3599, 3600.

3926. JAMES, L. M. **Property taxes and alternatives for Michigan.** *J. For.* 58 (2), 1960 (86–92). 18 refs.

Examines inequities in current systems of taxing forest property, criticizing taxation based on both land and standing timber values. A yield tax coupled with a standard land-tax payment—optional, but with restrictions, in Michigan—is preferred. Attention is drawn to two new tax laws, one in Maine (1953), assessing land according to its productivity, the other in Minnesota (1957), where tax will take 30% of the annual value increment of timber computed from mean figures for each county.

### 96. Forest Labour Questions. Labour Questions in Wood Transport and the Wood Industries

See also No. 3197.

3927. HELLÉN, E., *et al.* Metsä- ja uittotyöpalkkatarkkailu vuosina 1932–1957. **[Wage control in forestry and log-floating in Finland, 1932–57.]** *Silva fenn.* 96 (4), 1959. pp. 49. [Fi.*e.*]

Describes rises in wages against a varying local economic background, and the role of government, trade unions, and employers in establishing wage norms.

### 97. International Forest Policy and Other International Collaboration

### 971. Congresses, Conferences

See also Nos. 2839, 2843.

3928. **C.C.T.A./C.S.A. Meeting of specialists on open woodlands, Ndola, 17th–23rd November, 1959.** *Emp. For. Rev.* 39 (1), 1960 (68–88).

Tries to give a general picture of the meeting, including the lighter side as well as the scientific and professional aspects. The subjects covered were the extent, ecology, fire protection, management, and desirable lines of research, of *miombo* (open woodland with *Brachystegia/Isoberlinia* spp. predominating). The agenda is given, together with recommendations arising out of it, No. 9 of which recommends 16 papers to be included in the Ndola Meeting publication. A full list is given of the 32 papers submitted from many territories. Contributions to the supplement included here are: The Ndola Miombo Conference (*H. S. H. Watson*); 'Our' Conference (*G. H. D. Williams*); Impressions of an observer (*D. G. Cumming*); *Miombo* Conference impressions about inventory and management (*H. M. N. Lees*); Impressions of a botanist (*D. B. Fanshawe*); Impressions of a utilization officer (*B. E. Webb*); An impression of the *Miombo* Conference (*E. N. Cooling*).

3929. **Report of the fourth session of the International Chestnut Commission (Yugoslavia and Greece, September-October 1958).** FAO, Rome. No. *FAO/CH*/26, 1959. pp. 50 + 1 map.

Includes, in addition to the general report, a secretariat note on general policy, and economic and social problems, a note on *Endothia parasitica* in Jugoslavia (*M. Krstič* et al.), reports on study tours in Jugoslavia (*M. Anič* et al.) and Greece (*R. Morandini*), and a distribution map for the Mediterranean region, with annotations (*R. Morandini*).

## FORESTRY THE WORLD OVER

References: 1. *Angewandte Chemie*, Weinheim/Bergstrasse; 2. *Colonial Research*, Colonial Office, London; 3. *Daily Telegraph*, London; 4. *Empire Forestry Review*, London; 5. *FAO Forestry Newsletter for the Near East*, Rome; 6. *Forest Products Journal*, Madison, Wis.; 7. *Forestry Adviser's Newsletter*, Colonial Office, London; 8. *Holz-Kurier*, Vienna; 9. *Holz-Zentralblatt*, Stuttgart; 10. *Indian Forester*, Dehra Dun; 11. *Journal of Forestry*, Washington; 12. *Lesnoe Hozjajstvo*, Moscow; 13. *Nature*, London; 14. *Revista Forestal Argentina*, Buenos Aires; 15. *Revue Forestière Française*, Nancy; 16. *Soil Conservation*, Washington; 17. *Timber & Plywood*, London; 18. *Timber of Canada*, Toronto; 19. *Timber Trades Journal*, London; 20. *Timberman*, Portland, Ore.; 21. *Times*, London; 22. *Wood-Worker*, Indianapolis.

**Argentina**. The government of the province of La Pampa, Argentina, has inaugurated a new project to encourage afforestation in this region, where there are many and varied factors unfavourable to forest development. Contracts are being drawn up between government and landowners whereby the landowner provides land between 2 and 10 ha. in extent, already prepared for planting, and fenced where necessary. The work and expense of establishing the plantation is undertaken by the government and money is provided to the landowner to cover costs of tending during the first 3 years. The contract lasts for 40 years. When the products are finally harvested, 90% of the profit goes to the landowner and 10% to the government (**14**; Jan./March 1960).

**Austria**. On the invitation of the Moroccan Government, an Austrian architect has designed a partly prefabricated wooden house for use at Agadir, which can be quickly erected by unskilled labour. It is built of only 2 types of element, one solid, 1·25 × 2·50 m., for walls, floors and ceilings, the other, a frame of the same dimensions to be used upright as a doorway or horizontally for a window frame. The roof is made of wooden rafters covered by an aluminium skin (**8**; 31.3.60).

**British Honduras**. Extensive damage to living trees has been found to be caused by *Coptotermes niger*, both Mahogany and Pitch Pine being affected. This is a matter of some concern, since supplies of mature trees are rapidly diminishing, and afforestation on a large scale will be required to maintain the colony's principal export. In many parts of the tropics, afforestation with Eucalypts is hampered by soil-inhabiting termites, which attack the young trees during the first three years after planting out (**2**; 1959).

**Canada**. A new forest fire-fighting development in the Vancouver Forest District was the formation in July 1959 of an organization, Forest Industries Flying Tankers Ltd., B.C., equipped with four 4-engined, former U.S. Navy seaplanes, each of which is to be modified to carry a 7000-gal. water tank with quick-dumping doors. Scoops are to be used for picking up water while the aircraft is moving at high taxi speed, and flight trials are to start in 1960. The full load, dropped from 200 ft. alt., would fall over an area of ca. 1 acre, and it is estimated that each aircraft can make ca. 4 trips/hr. to any part of the forest area, saturating it with the equivalent of 1·33 in. of rain. It is claimed that, with an efficient warning system, the water bombers will be able to beat an outbreak of fire long before it reaches major proportions, and before comparable quantities of fire-fighting equipment could arrive by land or by the smaller aircraft now in use (**18**; April 1960).

**France**. The Union Nationale des Chambres syndicales de Charpente, Menuiserie et Parquets, organized in 1959 a competition for the design of a wooden church. The competition was open to student architects of the École Nationale Supérieure des Beaux-Arts, who were instructed to make maximum and best use of wood in the construction and decoration of a church for a congregation of 250 (**15**; May 1960).

A plant designed to produce 100 tons of hardwood pulp a day by a chemi-groundwood process, for use in the manufacture of newsprint, was recently completed at Corbehem, Pas de Calais, France. It is claimed to be the first of its kind in Europe (**6**; Feb. 1960).

**Germany**. According to reports in a local newspaper, a forest fire near Würzburg in March 1960 had to be fought with skimmed milk, as no water was available (**9**; 25.5.60).

A recent report of an official inquiry on the economics and reorganization of the German railway system discusses the merits of concrete and wood for sleepers. In view of various circumstances, including the existence of stocks of old metal fittings etc., and the interests of state forest departments, it is proposed to use ca. 50% wooden sleepers for the time being, but to step up the use of concrete to ca. 66% eventually, in the interests of rationalization and mechanization of maintenance work (**9**; 12.4.60).

A product of the Desowag-Chemie, Düsseldorf, called Xylacolor, permits the application of wood preservative and colour in one coat. The combination of insecticides, fungicides, artificial resin and pigments (6 colours) can be applied to unseasoned wood (**1**; Sept. 1959).

**Great Britain**. A post-graduate diploma course in nature conservation will be inaugurated at University College, London, in July. It will consist of an initial period of field work, extensive and exploratory in character, followed by two terms of indoor teaching, and finishing with a second period of more intensive field work. The course will be run by the Botany Department, in collaboration with the Geography and Zoology Departments of University College, with assistance from other departments and a wide range of seminars. The syllabus will include the physical factors of the environment, plant and animal ecology, and a study of different forms of land use and their effect on soils, plants, and animals. This fundamental grounding should be applicable to conservation problems in different parts of the world (**13**; 19.3.60).

A land-use survey of England and Wales, in map form, is being organized by Miss Alice Coleman, Lecturer in Geography at King's College, London, and Mr. K. R. A. Maggs of Broadstairs. The proposal for the survey came from the Thanet Geographical Association, which carried out a pilot survey of 500 sq. miles in East Kent. There will be 60 categories in the survey, ranging from the finer distinctions of agricultural use to the basic vegetation types of heath and moorland areas. The field data will be recorded on a scale of 2½ in. to the mile. Printing will be in 9 colours, and the sheets are expected to appear later this year (**3**; 28.3.60).

The firm of Nash and Thompson is now putting a 'sketchmaster' instrument on the market. This superimposes the image of a single aerial photograph on to any map the scale of which is within the range 0·4 to 2·0 times that of the photograph, i.e. a 1 : 20,000 photograph can be fitted to maps of scales between 1 : 50,000 and 1 : 10,000. It can be used with moderately tilted photographs, such as 'split verticals', as well as with truly vertical photographs. The single-print view cannot, of course, correct for height displacements, so the sketchmaster must be used with discretion when handling photographs of rough country. It is, however, the simplest and quickest instrument for transferring information from photographs to maps of a different scale. The present model, complete with lenses, peep-sight and legs of two lengths, but exclusive of carrying case, costs £85 (**7**; Oct. 1959).

Following the successful competition for forestry machinery staged at Nuneham Courtenay, near Oxford, in 1958, the R.A.S.E. announces a new competition for 1960. This aims at encouraging the development of machines for cutting or clearing drains in young forest plantations where trees are usually planted 5–7 ft. apart, or in a coppice. It is hoped that the competition will bring to light new ideas for cleaning drains, particularly on wet peat soil, the drains to be at least 18 in. deep, and ≮ 18 in. wide at the bottom. Points to be taken into consideration by the judges will include ability to operate in a space confined by standing trees; rate of output and over-all cost per chain; capital cost of the machine; mechanical reliability; quality of the work. Machines will probably be judged in Nov. 1960, and successful entrants will exhibit their machines at the Royal Show at Cambridge in July 1961 (**4**; March 1960).

The population of adders in the New Forest is believed to be not fewer than 25,000. This plain statement, with the word adders and the figure in bold black print, beneath an equally bold and heavily underlined word, 'Warning', is being handed as a leaflet to those obtaining camping permits from the Forestry Commission offices at Lyndhurst and elsewhere in the New Forest. The long, sunny summer of 1959 favoured the breeding of adders. The figure now given has been worked out by a Swedish herpetologist who has made frequent visits to the area during the past 12 years (**21**; 26.5.60).

A large flock of starlings has destroyed a 7-acre plantation of trees on the Duke of Devonshire's Chatsworth estate and is flying over surrounding farmland in search of food. Forestry and farming experts have confessed themselves helpless to disperse them, and the plantation will have to be felled (**21**; 23.3.60).

A recent report from British Glues and Chemicals Ltd. reflects the increasing interest in leaf protein. The Chayen impulse process, introduced a few years ago by this firm for the disintegration and extraction of bones and animal fats, has now been applied to a variety of other materials such as groundnuts and grasses. The principle of the method lies in the use of shock waves of sufficient intensity and frequency to burst the tissues and cells of biological materials. The report states that 100 tons of fresh grass (of 80% water content) treated by the Chayen method yields ca. 2¼ tons of edible protein together with two important by-products—7 tons of fibre (suitable for the production of hardboard) and 0·6 tons of a 'chlorophyll syrup' containing fat-soluble vitamins, pigments, and steroids (**13**; 26.3.60).

The ancient dovecote of Dunster, Somerset, has just been X-rayed, to see why its massive internal ladder rotates so freely on an unoiled bearing believed to be 400 years old. This ladder, which is supported on a frame rotating round the axis of the building, is 16 ft. high and is carried round in a circle of 6 ft. radius. The main element of the frame is a massive post of Ash, 16 ft. high and 6–7 in. square. The total weight of the rotating structure is estimated at 475 lb. The X-ray examination showed that this structure rotates about an iron pin, one inch in diameter, fixed into a beam in the floor and extending some 7 in. into the bottom of the post, with a rounded end that fits into a metal cone-shaped spike driven up into the post (**21**; 21.3.60).

A new synagogue to be built at Carmel College, Mongewell, Oxfordshire, the design of which is based on the Israelites' tents of Old Testament days, will be almost entirely constructed of laminated timber. There are no internal supports, though the synagogue, 104 ft. by 86 ft., will hold 500 people (**3**; 23.4.60).

The new Rising Sun Inn at Clanfield, Hants, a pre-fabricated house of Canadian Cedar, was erected in 12 hours on the 26th May. Soon after 5 a.m., the first of 12 lorries unloaded one section of the building (the public bar) on to the relevant part of the foundations; some 6 hours later, the last of the lorries discharged the last section (the saloon bar) into position. At 6 p.m. the Rising Sun was fully open, with refreshment available to all its patrons. Clanfield, which has no other pub, had only 5 weeks of a temporary Rising Sun between demolition of the old building and the erection of a new one. The 12 completed sections of the Rising Sun had been transported overnight from the factory at Southall, to a series of lay-bys on the London-Portsmouth road. Each section was complete down to decoration, roofing, and glazing, and, where possible, fittings such as bars and counters were built in and electrical wiring installed. Of the 40 workmen engaged on the operation, only 8 ranked as the erection gang; 14 were carpenters, 5 plumbers, 4 electricians, 3 painters, and 5 labourers (**21**; 25.5.60).

When felling timber at Glan Ceiro, Llangwin, near Corwen, the firm of Wm. Coward and Co., Llangollen, were warned by one of the village's older inhabitants that a bell was embedded in the trunk of a large Ash tree. The bell was reputed to have been hung in a fork of the tree in order to call field workers to meals, and it had never been removed after the custom lapsed. During sawmilling the bandsaw was damaged by something buried in the heart of the stem, and when the butt had been split open with wedges the bell was revealed (**19**; 21.5.60).

A new automatic length-sorting machine at the yard of the Phoenix Timber Co. is reported to give the largest output per man of any similar equipment in Europe, and probably in the U.S.A. and Canada. Designed by the B. and A. Engineering Co., Ltd. of Pall Mall, London, it can handle up to 28,000 pieces of timber a day with a team of 12–14 men, and sorts boards between 6 and 24 ft. long into 17 different groups. At the same yard a new electronic measuring and recording instrument has been successfully used in a smaller sorting machine. The instrument measures and records automatically the length and width of each piece of timber as it passes over the conveyor rolls, and tallies batches of any size (**19**; 21.5.60).

Eight hundred 1-ft.-square samples from the great range of hardboards, fibre insulating boards and acoustic tiles available in the U.K. are on display in the board library set up by the Fibre Building Board Development Organisation (FIDOR) at its headquarters in London. The exhibits, representing 13 manufacturing countries, are for reference only and, it is thought, provide a unique service for specifiers (**17**; 28.1.60).

The latest product of the Celcure and Chemical Co. Ltd.—'Celcure F'— is said to give complete protection against fungal and insect attack as well as being flame-retardant. It is applied to wood by a special pressure process. The company has also developed a flame-proof coating for application by brush or spray (**4**; March 1960).

**India**. It has been decided to bring out 'One hundred years of Indian Forestry—a Souvenir: 1961' at the time of the Centenary of Forest Departments in India, which is scheduled to be celebrated in 1961. Articles are invited from all foresters in India and abroad, who were or are, closely associated with Indian forestry, on their reminiscences or noteworthy forestry developments during their time, for incorporation in the above publication (**10**; April 1960).

A light-weight plywood hut, cylindrical in shape, is to be erected on a col ca. 20,000 ft. up in the Himalayas, by the physiological and mountaineering expedition led by Sir Edmund Hillary. Each of the 100 interlocking sections weighs ca. 14 lb. The hut, 22 ft. long and 10 ft. in diameter, will provide the base shelter for the expedition, and will have to be erected and dismantled at various cols during the climb. It was designed by the chief architect of the T.D.A. in collaboration with Sir Edmund. There will be space for 8 men and a specially equipped laboratory (**3**; 19.5.60).

**Iraq**. In the summer of 1959 a Forestry Institute was founded at the University of Bagdad which, for the time being, is attached to the College of Agriculture. The courses (at present attended by 35 students) last for 26 months. The teaching is partly in Arabic and partly in English. It is intended later to move the Institute to the northern part of Iraq, close to the existing forests. Successful students will be given charge of forest districts and a few highly qualified ones will be selected out of each course for advanced university studies (**5**; 15.2.60).

**Norway**. A Norwegian fisheries researcher claims to have discovered a significant correlation, over the period 1885–1958, between the annual catch of skrei (spawning cod, *Gadus callarias*) in the Lofoten fishing area, northern Norway, and the growth-ring pattern of Scots Pine on the mainland near by, as analysed by Ording [see *F.A.* 5 p. 144]. The factors determining the width of the annual ring appear also to determine the size of the year-class of the skrei, and the growth-ring series allow reliable forecasts of the annual catch (**13**; 16.1.60).

Under the auspices of the Norwegian Association of Manufacturers, a study was made of the operation of an automatic timber-stacking machine that lifts boards from ground level to the top of the stack. In building a 25 × 20-ft. stack to a height of about 22 ft., the machine and its 3-man crew showed a mean total time per board of 0·15 min., with one man loading boards on to the machine and two men taking each board from the discharge arms, turning it through 90° and placing it on the pile (**22**; March 1960).

**Solomon Is**. Small-scale experimental work on *Pometia pinnata* and forest dominated by this species has been initited. *P. pinnata* is the commonest timber tree in the Solomon Is. and seems likely to be of considerable importance to their forest economy (**2**; 1959).

**Tanganyika**. The Forest Department in the Lake Province is to encourage development by licensed cultivators of the 8000-acre Rubya Forest Reserve at the western tip of Ukerewe Island. This will be the first large afforestation scheme in the Lake Province, and cultivators will be given the opportunity to move in, clear the thicket and bush, and plant their crops. In the second year, the Forest Department will work alongside them, planting trees as they plant their crops. Each year, new plots will be allocated to the cultivators, so that planting-up of the reserve will be a continuous process with fresh land to which the cultivator can move. In 10–15 years the entire reserve will have been cleared and planted, and the first timber will be coming out of the plantation. Three years ago experimental plots were planted with *Maesopsis eminii*, a fast-growing tree, and it is already apparent that it will grow well. Among other promising trees are certain Pines from Central America. Rubya will be the first step in satisfying the very great need for timber in the Lake Province (**4**; March 1960).

**U.S.A.** At a meeting of the Council of the Society of American Foresters in San Francisco in Nov. 1959, a motion was unanimously passed to request the Division of Forest Management to appoint a committee to study the use of the cubic foot, and also the use of other absolute tree measurements as the Division may desire, and to prepare a procedural statement (**11**; Feb. 1960).

Prefabricated seasoning kilns are proving especially suited to the needs of small woodworking concerns in the U.S.A. They are said to afford the same degree of protection against the outside elements and loss of steam as larger and more elaborate kilns, their quick-assembly panels offering good insulation and, with sealed joints and wrap-round corners, effectively preventing both outside and inside leakage. In some cases panels have the rated insulation properties of 100 in. of concrete, and are fitted with rubber gaskets at the joints and doors, while the drying equipment and controls are of the same quality as those used in the larger kilns. The prefab kilns are claimed to be adaptable to most small-plant drying requirements, their modular design permitting a wide flexibility without custom-built costs (**22**; January 1960).

A logger, Albert Rue, of Sutherlon, Oregon, has developed an unorthodox, but simple, method of felling a tree in short lengths. A light power chain-saw is used in conjunction with a light line and winch, or a hydraulic wedge. So far the logs have sustained no damage in falling. The method offers particular advantages near power lines or telephone cables, where felling by orthodox methods might cause difficulty (**20**; April 1960).

Wooden water-pipes estimated to be 120 years old were dug up recently in downtown Chicago and found to be in excellent condition, according to the National Lumber Manufacturers Association. City engineers said the pipes, made from White Pine logs 11 in. in diameter with a 4-in.-diameter hole, could still be used for their original purpose (**16**; April 1960).

**U.S.S.R.** Special plates with projecting spikes have been made for bolting on to the track-plates of crawler tractors. As the tractor moves forward, the spikes make regularly spaced holes in the ground for subsequent planting of seedlings (**12**; March 1960).

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